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F.J. Sargent, M.M. Colby, and W.G. Lyons
Florida Marine Research Institute
Department of Environmental Protection
100 8th Avenue, S.E.
St. Petersburg, Florida 33701

R.G. Gilmore, Jr., and J.K. Reed
Harbor Branch Oceanographic Institution, Inc.
5600 Old Dixie Highway
Fort Pierce, Florida 34946

G.A. Zarillo, K. Connell, and M. Fillingfin
Division of Marine and Environmental Systems
Florida Institute of Technology
150 West University Boulevard
Melbourne, Florida 32901

F.M. Idris
Georgia Southern University
Applied Coastal Research Laboratory
10 Ocean Science Circle
Savannah, Georgia 31411

FINAL REPORT

Submitted to the Southeast Area Monitoring and
Assessment Program
and
National Marine Fisheries Service
Pursuant to National Oceanographic and
Atmospheric Administration Award No.
NA47FS0036

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EXECUTIVE SUMMARY

Marine fisheries scientists, user groups, and resource managers in the southeastern Atlantic states have determined that there is need for accurate information on the location and extent of hard-bottom habitat, which is of importance to the maintenance of reef-fish stocks. Reef fish have declined to such low levels that reproductive stocks are often inadequate to maintain current populations, and some fisheries stocks may be approaching a state of collapse. In order to meet this need for information, a Bottom Mapping Work Group was formed in 1985 by the SEAMAP management committee. The work group developed a plan for establishing a bottom-mapping database using historical information obtained from surveys of the study area, and a study was subsequently initiated to describe and characterize hard-bottom resources in the South Atlantic Bight. The initial segment of the study was conducted by scientists in South Carolina and Georgia (Van Dolah et al., 1994), and the study was continued by scientists in North Carolina (Moser et al., 1995). A total of 23,960 records with information on location and type of bottom were compiled during the first two segments of the study. The SEAMAP Bottom-Mapping Study was initiated by Florida in 1994.

The Florida study group has 1) expanded the list of hard-bottom-obligate fishes to 264 taxa, 2) developed a protocol for using specimen-collection-based information to acquire evidence of bottom type, and 3) developed a protocol for incorporating areal data into the database so that the area-data records are equivalent to those of the point and line-segment records incorporated into the database during the first two segments of the study. The Florida group has incorporated an additional 20,787 records from 37 sources with determinations of bottom type into the database. Of these records, 900 are derived from 9 areal databases, primarily from surveys that used side-scan sonar, and an additional secondary data table (Appendix 4) that summarizes those records has been added to the database. Approximately 37% of the grid cells in the Florida study area contain some data on bottom type, and the database now totals 44,747 records.

INTRODUCTION

Hard bottom, whether composed of living coral, rock outcrops, artificial reef material, or other types of structure, provides habitat for a unique and diverse faunal and floral community. Many of the species in this community are almost totally dependent on this habitat during at least a portion of their life cycle. Many of these hard-bottom species are also the subject of valuable fisheries. Over much of the continental shelf, however, hard bottom constitutes only a small percentage of the total area of bottom, and in order to protect and/or manage this critical habitat we need to know its location and extent. This knowledge is particularly critical in fisheries management (e.g., stock assessment and planning for marine reserves) and in protecting habitat from such activities as oil and mineral exploration and destructive fishing practices (Dustan et al. 1991; Bohnsack, 1992).

In order to meet this need, the Southeast Area Monitoring and Assessment Program (SEAMAP-SA) Committee created the South Atlantic Bottom Mapping Work Group in 1985. This group was composed of representatives from the states of Florida, Georgia, South Carolina, and North Carolina, as well as from the National Marine Fisheries Service and the South Atlantic Fisheries Management Council. The group's charge was to develop a database concerning the location and characteristics of hard-bottom habitats shallower than 200 m in the South Atlantic Bight (SAB). This database would primarily be used by planners and managers. Reports have been produced for South Carolina and Georgia waters (Van Dolah et al., 1994) and for North Carolina waters (Moser et al., 1995).

The charge for Florida was to produce a database for hard-bottom habitats in Florida waters north of Jupiter Inlet. Although there has been no comprehensive documentation of hard-bottom habitat in this region, several studies have given the location of specific hard-bottom areas (e.g., Hurley et al., 1962; Moe, 1963; Avent et al., 1977; Avent and Stanton, 1979; Reed, 1980, 1981, 1983, 1992; Reed and Gilmore, 1981; Reed et al., 1982; Hoskin et al., 1983, 1987; Sedberry and Van Dolah, 1984; Reed and Mikkelsen, 1987), and at least one study has provided an estimate of the amount of reef habitat in this region (Parker et al., 1983). Locational data from these studies that were determined to be sufficiently accurate were incorporated into this report.

METHODS

Methods follow the protocols developed by Van Dolah et al. (1994) and adapted by Moser et al. (1995) in the two preceding segments of this study, unless specified below. The structure of the primary data table is summarized in Table 1. The structure of the secondary data table describing the projects or sources of the data is summarized in Table 2. Table 3 summarizes the structure of the secondary data table that provides information on the number and types of records in grid cells. Table 4 summarizes the structure of a new secondary data table that provides information derived from polygon or areal data (see below) of the areal percentages of bottom types in grid cells. We have

Table 1. **Structure of primary database table containing records of historical data that provide evidence of locations of bottom types on the Florida continental shelf.**

Field	Description
Block	Unique code for each 1 minute by 1 minute grid cell established for the survey area; code represents latitude and longitude of southeastern corner of grid cell.
Date	DDMMYY (day/month/year) of the collection or date of report publication if the collection date was unavailable.
Agency	Code for agency and project that provided data.
Origcoll	Original collection number; typically the concatenation of identifying variables associated with the sampling event, e.g., cruise number, station number, vessel code. Start/End/Lat/Lon Data-collection locations. Start and end coordinates in latitude and longitude, respectively.
Posmet	Code describing the positioning method used.
Corfac	Code describing corrections made to position coordinates by the original researcher.
Gear	Code for gear used to collect data.
Depth	Station depth or depth at start and end of sample or data collection, in meters.
Btm_Typ	Code for bottom type as one of the following categories: hard bottom (HB), probable hard bottom (PH), no evidence of hard bottom (NH), artificial structures (AR), hard bottom and artificial structures (HA).
Relief	Maximum bottom relief in meters: low (<0.5 m), medium (0.5 - 2 m), high (>2 m).
State	Code identifying the state that assembled the data.
Data_Typ	Code identifying point (P), line (L), or areal (A) data.
Uniq_id	Identification number unique to each record.

also augmented the list of hard-bottom-obligate fishes to include additional species found in the Florida segment of the SEAMAP Bottom Mapping Study (Table 5), added a short list of hard-bottom invertebrates (Table 6), and incorporated the use of data included in specimen-collection databases.

THE SURVEY AREA

The survey area is the eastern continental shelf of Florida from the coastline to the 200-m contour between the Georgia border and the vicinity of Jupiter Inlet where the continental shelf narrows dramatically. The latitudinal limits we used to select our

Table 2. Structure of secondary database table containing information on the source of each record in the primary table (see Appendix 2).

Field	Description
Agency	Agency project code for relation to primary database.
Pos_Prec	Position precision (original units in which position was reported).
Sourc_co	Identifies the state from which data were obtained.
Proj_Tit	Project title.
Fund_Age	Source of original funding.
Grant_Nu	Original grant number.
Prin_Inv	Principal investigator.
Company	Company or agency that performed the study.
Street	Company or agency information.
State	
Zip	
FAX	
Phone	

data extended slightly north and south of this area, from 26°56'N to 30°44'N. In order to include transect data for start locations within the depth range but end locations outside of it and to include other important data, we also extended the grid into deeper water in certain areas to include all areas within which such data are reported. The study area was divided into 11,365 "blocks" or grid cells, each with a size of one minute of latitude by one minute of longitude (Figure 1). Each grid cell is identified by an eight-digit number that is derived from the coordinates of the southeast corner of that cell. Block numbers are used to help describe data-collection locations (Appendix 1) and to provide an overview of bottom types occurring within each grid cell (see Appendices 3 and 4).

DATA TYPES

Three types of data were used for mapping bottom-type information: 1) point data, 2) line-segment data, and 3) polygon or areal data (see below). Point data are primarily records that, due to the kind of sampling gear used (e.g., benthic grab) or type of observation made, provide bottom-type information for a single coordinate. Point data were also generated, however, by samples of hauled gear (e.g., trawls) when researchers only recorded one location along the transect. Line data include records obtained for transects (e.g., trawl surveys, some dredge surveys, certain side-scan sonar data, some diver observations) that are defined by beginning and ending coordinates. Line data from trawls and dredges that cross 1-minute grid lines are included in the database as single records, and the bottom-type determination for each such record is included only for the start coordinates recorded for that trawl or dredge sample. For other types of line data, which indicate more accurate bottom-type locations (e.g., sonar tracks and diver observations), a unique record is included in the database for each grid cell in which the bottom-type determination was recorded in the grid. All records of trawls and dredges included in the database were limited to tow durations of 60 minutes or less.

Records collected by trained divers associated with local organizations are also included in the database(see discussion of databases FL10, FL11 and SP05, below). These divers were trained in a program sponsored by Florida Sea Grant (see Halusky, 1991). The program consists of workshops on scientific diving, use of photography and video in collecting data, underwater mapping, biological sampling, sampling reef fish populations, and planning a local reef research program. Staff of Florida Sea Grant evaluated divers from the Jacksonville area in 15 performance areas and found their efforts credible in collecting a variety of environmental data (Halusky et al., 1994).

POLYGON OR AREAL DATA

In addition to the point and line data used in the two previous reports of the SEAMAP Bottom-Mapping Study (Van Dolah et al., 1994; Moser et al., 1995), we have identified polygon data as another type of information for inclusion in the bottom-mapping database. Polygon data are Geographic Information System (GIS) data defined by a series of coordinates that, when connected, form a closed polygonal region. We have presented these data so that the structure in which they are presented is equivalent to points or line segments in the current bottom-mapping database, while remaining consistent with GIS protocols. Polygon data are more informative and are usually more geographically accurate than point and line data.

Most of these data were produced during bottom-mapping surveys, usually conducted for the U.S. Army Corps of Engineers for beach nourishment and borrow sites or dredged-material disposal sites. One data set was compiled from aerial photography. In addition, another data set was compiled from a U.S. Army Corps of Engineers "Coast of Florida Erosion and Storm Effects Study," which was conducted in cooperation with the Florida Department of Environmental

Protection, Bureau of Beaches and Coastal

Table 3. Structure of the secondary database table that summarizes the number of data records and bottom type in each 1-minute x 1-minute grid cell (see Appendix 3).

Field	Description
Block	The code for relation to the primary data table. The code represents the latitude and longitude of the southeast corner of the grid cell.
N_Obs	Total number of observations within the grid cell.
HB	Number of records with evidence of hard bottom within the grid cell.
PH	Number of records with probable hard bottom within the grid cell.
NH	Number of records with no evidence of hard bottom within the grid cell.
AR	Number of records with evidence of artificial reef structure within the grid cell.
HA	Number of records with hard bottom and artificial reef within the grid cell.

Table 4. Structure of the secondary database table that summarizes information on areal percentages of bottom types within the 1-minute grid cells derived from polygon data. Percentages of area within grid cells not surveyed, surveyed but not reported, or outside the study area (e.g., on land) are not reported.

Field	Description
Block	Code for each 1-minute by 1-minute grid cell established for the survey area that contains information on bottom type derived from polygon data; code represents latitude and longitude of southeastern corner of grid cell.
N_Obs	Total number of observations within grid cell derived from polygon data.
HB_Pct	Percentage of area within grid cell that shows evidence derived from polygon data of hard bottom.
PH_Pct	Percentage of area within grid cell that shows evidence derived from polygon data of probable hard bottom.
NH_Pct	Percentage of area within grid cell, as derived from polygon data, that shows no evidence of hard bottom

Systems, and which covered the area out to about 100 ft depth and extending south from about the Palm Beach-Martin County line to off southern Key Biscayne. The Corps has requested that we not release these data directly; however, we provide maps (4 pages) showing the locations of hard bottom determined during the study. This study is expected to be continued in the area extending north from the Palm Beach-Martin County line to Cape Canaveral.

The following protocols are used for presenting data for polygon data sets. In the primary database file (Appendix 1), a unique number (**Uniq_id**) is assigned to each polygon for each grid cell in which it occurs. Therefore, a polygon that occurs in four grid cells is recorded in Appendix 1 as four unique records. The **Uniq_id** relates information for each record in the primary data table to each polygon reported in ArcInfo export files and associated data tables. Data for latitude and longitude are not included in the **Start\Lat\Lon** or **End\Lat\Lon** fields because that information is included in the **Block** field. No data on depths for polygons are currently available to include in the **Depth** and **Depth_en** fields. Corrections to the original positions, which are usually part of the original mapping effort, are included in the **Corfac** field as appropriate. Available data are included in other fields in the primary data table.

The secondary database file (Appendix 2), containing information about the sources of each record in the primary data table, is unchanged; however, the **Agency** field relates this table to the polygon data in Appendix 1 and to the ArcInfo export and associated files.

The secondary data table that summarizes data records in each 1-minute by 1-minute grid cell (Appendix 3) is unchanged. The number of observations within each grid cell (all observations from points, line segments, and polygons) is reported in the appropriate fields.

Appendix 4 is a new secondary database file that contains information about the areal percentages for each grid cell of hard bottom, probable hard bottom, no evidence of hard bottom, and area within the grid cell not surveyed, as determined from polygon data. This data table contains a **Block** field, an **N_Obs** field that reports the number of observations of polygon data within that grid cell, and three fields that contain information about the areal percentages of each bottom type determined within the grid cell (**HB_Pct**, **PH_Pct**, and **NH_Pct** fields). The areal percentages are calculated from information in the ArcInfo files. The sum of the **N_Obs** field is the number of polygon records in Appendix 1.

ArcInfo export files, associated ASCII tables, and other associated files for each polygon data set are identified by the **Agency** code field; each polygon in each grid cell in the data set is identified in the **Uniq-id** field; and ArcInfo files are related by those fields to other tables of the relational database (Appendices 1 and 2).

The distribution of grid cells and principal bottom types determined from polygon data are included, in the established priority (along with the determinations derived from points and line segments), on the summary map of the survey area showing grid cells that contain information on bottom type (Figure 2). However, bottom types determined from polygon data, in some cases, will hardly be visible at the scale of the detailed maps showing locations of point and line data (Figures 4-9). Therefore, bottom-type determinations derived from polygon data are presented on a separate series of maps (Figures 11-19) so the reader can adequately visualize the data.

HARD-BOTTOM FISHES

A list of pertinent Florida species to be added to the list of hard-bottom-obligate and structure-oriented fishes originally prepared by Van Dolah et al. (1994) was reviewed by G. Sedberry and S. Ross and reviewed and approved by members of the Bottom-Mapping Work Group. The additions are indicated by asterisks in the current list of obligate hard-bottom fishes (Table 5). The rationale for adding species to the list is included below.

SEAMAP protocol for determining the location of hard-bottom habitat has included the examination of trawl and trap data sets for the presence of fish species considered to be good indicators of the presence of hard bottom (see citations in previous reports). For this purpose, a list of fishes considered to be hard-bottom obligates (including 171 species, 1 hybrid, and 2 genera) was developed by George Sedberry and Steve Ross and adopted by the SEAMAP Bottom Mapping Work Group. We determined that many hard-bottom species occurring in continental shelf waters along the Florida Atlantic coast were not included. Therefore, we developed a list of species, genera, and families of fishes that are considered to be hard-bottom obligates, that are known from Atlantic coast continental shelf waters (0-200 m depth) north of Jupiter Inlet in the Florida segment survey area (26°56'N to 30°44'N), and that were not included in the SEAMAP list as modified by Moser et al. (1995). The Florida list was developed from personal knowledge, discussions with colleagues, and from the review of 56 references indicated by an asterisk in the Literature Cited. We were fairly conservative in this endeavor in that we did not include species for which habitat preferences were questionable. Inclusion of some of these species, however, does raise some of the same questions that one would raise about many of the species included on the former SEAMAP list. Most of these questions involve ontogenetic and/or locational changes in habitat utilization. The former type of change involves several species in families such as Lutjanidae and Balistidae, which use either seagrass habitats or pelagic (e.g., *Sargassum*) habits as nursery areas (Hardy, 1978; Bortone et al., 1977). We cannot deal with this problem without knowing the size of each individual collected. The latter questions involve species that may be found in habitats such as grass beds when in shallow, inshore waters but are only reported from hard-bottom areas in deeper water. This would not seem to be a problem because almost all of the trawl data are from offshore areas. Examples of species included under this heading would be various apogonids, lutjanids, and haemulids (Hardy, 1978; Gilmore et al., 1981). We have also followed the lead of the developers of the original list and included several haemulids despite their nocturnal migrations to feeding areas away from their hard-bottom resting areas. Finally, the additional genera and families are not intended to be an exhaustive

Table 5. **List of hard-bottom-obligate fish taxa (and synonyms or probable synonyms) used in the Florida segment of the study. Taxa added to the existing list created by Van Dolah et al. (1994) and revised by Moser et al. (1995) are indicated by an asterisk. Records of *Gymnothorax nigromarginatus* and *G. ocellatus* probably refer to *G. saxicola* (Böhlke et al., 1989)**

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1. *Abudefduf saxatilis*
2. *Acanthurus bahianus*
3. *Acanthurus chirurgus*
4. *Acanthurus coeruleus*
5. *Anarchias similis* (*Anarchias yoshiae*)
6. **Anisotremus surinamensis*
7. *Anisotremus virginicus*
8. *Antennarius ocellatus*
9. *Antennarius radiosus*
10. *Antennarius striatus* (*Antennarius scaber*)
11. *Anthias nicholsi*
12. **Anthias* sp.
13. *Apogon affinis*
14. *Apogon aurolineatus*
15. **Apogon binotatus*
16. *Apogon maculatus*
17. **Apogon planifrons*
18. *Apogon pseudomaculatus*
19. *Apogon quadrisquamatus*
20. **Apogon* sp.
21. *Apogonidae
22. *Archosargus probatocephalus*
23. *Astrapogon alutus*
24. *Balistes capriscus*
25. *Balistes vetula*
26. *Bodianus pulchellus*
27. *Bodianus rufus*
28. **Calamus calamus*
29. *Calamus nodosus*
30. *Calamus proridens*
31. *Canthigaster rostrata*
32. *Caulolatilus chrysops*
33. *Caulolatilus cyanops*
34. *Caulolatilus microps*
35. **Centropristis fuscula*
36. *Centropristis ocyurus*
37. *Centropristis striata*
38. **Centropyge argi*
39. **Chaenopsis limbaughi*
40. *Chaetodon aculeatus*
41. *Chaetodon aya*
42. *Chaetodon capistratus*
43. *Chaetodon ocellatus*
44. *Chaetodon sedentarius*
45. **Chaetodon* sp.
46. *Chaetodon striatus*
47. *Chaetodontidae
48. **Chilomycterus antennatus*
49. **Chilomycterus atinga*
50. *Chromis cyanea*
51. *Chromis enchrysurus*
52. *Chromis insolata* (*Chromis insolatus)*
53. *Chromis scotti*
54. **Chromis* sp.
55. *Clepticus parrae* (*Clepticus parrai*)
56. *Conger oceanicus*
57. **Cookeolus japonicus*
58. *Corniger spinosus*
59. **Coryphopterus dicrus*
60. **Coryphopterus personatus*
61. *Coryphopterus punctipectophorus*
62. *Decodon puellaris*
63. *Diodon holocanthus*
64. *Diodon hystrix*
65. **Diplodus argenteus*
66. *Diplodus holbrooki*
67. *Doratonotus megalepis*
68. *Emblemaria atlantica*
69. **Emblemaria pandionis*
70. **Enchelycore carychroa*
71. **Enchelycore nigricans*
72. **Enneanectes altivelis*
73. **Enneanectes pectoralis*
74. *Epinephelus adscensionis*
75. **Epinephelus afer*
76. *Epinephelus cruentatus*
77. *Epinephelus drummondhayi*
78. *Epinephelus fulvus*
79. *Epinephelus guttatus*
80. *Epinephelus inermis*
81. *Epinephelus itajara*
82. *Epinephelus morio*
83. *Epinephelus mystacinus*
84. *Epinephelus nigritus*
85. *Epinephelus niveatus*
86. **Epinephelus* sp.
87. *Epinephelus striatus*
88. *Equetus acuminatus* (*Equetus pulcher)*
89. *Equetus iwamotoi* (*Pareques iwamotoi*)
90. *Equetus lanceolatus*
91. *Equetus punctatus*
92. **Equetus* sp.
93. *Equetus umbrosus* *(Pareques umbrosus)*
94. **Eupomacentrus* sp.
95. *Evermannichthys spongicola*
96. *Gnatholepis thompsoni*
97. *Gobiosoma ginsburgi*
98. **Gobiosoma macrodon*
99. **Gobiosoma oceanops*
100. *Gobiosoma xanthiprora*
101. *Gymnothorax funebris*
102. *Gymnothorax hubbsi*
103. **Gymnothorax kolpos*
104. *Gymnothorax miliaris* (*Muraena miliaris)*
105. *Gymnothorax moringa*
106. *Gymnothorax saxicola* *(Gymnothorax nigromarginatus)* *(Gymnothorax ocellatus)*
107. *Gymnothorax vicinus*
108. **Haemulon album*
109. **Haemulon carbonarium*
110. **Haemulon chrysargyreum*
111. **Haemulon flavolineatum*
112. **Haemulon macrostomum*
113. **Haemulon melanurum*
114. **Haemulon parra*
115. *Haemulon plumieri*
116. *Haemulon sciurus*
117. *Haemulon striatum*
118. **Halichoeres bathyphilus*
119. *Halichoeres bivittatus* *(Halichoeres bivittata)*
120. *Halichoeres caudalis*
121. *Halichoeres cyanocephalus*
122. *Halichoeres garnoti*
123. *Halichoeres maculipinna*
124. **Halichoeres pictus*
125. *Halichoeres poeyi*
126. *Halichoeres radiatus*

127.**Halichoeres* sp.
128. *Hemanthias aureorubens*
129.**Hemanthias leptus*
130.**Hemanthias* sp.
131. *Hemanthias vivanus*
132. *Holacanthus bermudensis*
(Holacanthus isabelita)
133. *Holacanthus bermudensis x ciliaris*
134. *Holacanthus ciliaris*
135.**Holacanthus* sp.
136. *Holacanthus tricolor*
137. *Holanthias martinicensis*
138. *Holocentrus adscensionis*
139. *Holocentrus bullisi*
(*Adioryx bullisi*)
140.**Holocentrus marianus*
141. *Holocentrus rufus*
142.**Holocentrus* sp.
143.**Holocentrus vexillarius*
144.**Hypleurochilus aequipinnis*
145.**Hypleurochilus bermudensis*
146. *Hypleurochilus geminatus*
147.**Hypleurochilus springeri*
148. *Hypoplectrus unicolor*
(Hypoplectrus aberrans)
(Hyplplectrus indigo)
(Hypoplectrus nigricans)
(Hypoplectrus puella)
149.**Hypsoblennius hentz*
150.*Labridae
151.**Labrisomus gobio*
152.**Labrisomus haitiensis*
153.**Labrisomus nuchipinnis*
154. *Lachnolaimus maximus*
155.**Lactophrys bicaudalis*
156. *Lactophrys polygonia*
157. *Lactophrys trigonus*
158.**Lactophrys triqueter*
159. *Liopropoma eukrines*
160. *Lutjanus analis*
161. *Lutjanus apodus*
162. *Lutjanus buccanella*
163. *Lutjanus campechanus*
164. *Lutjanus griseus*
165. *Lutjanus jocu*
166.**Lutjanus mahogoni*
167. *Lutjanus purpureus*
168. *Lutjanus synagris*
169. *Lutjanus vivanus*
170. *Lythrypnus nesiotes*
171. *Lythrypnus phorellus*
172. *Lythrypnus spilus*
173.**Malacoctenus macropus*
174.**Malacoctenus triangulatus*
175. *Microspathodon chrysurus*
176. *Mulloidichthys martinicus*
177. *Mullus auratus*
178. *Muraena retifera*
179. *Muraena robusta*
180. *Mycteroperca bonaci*
181. *Mycteroperca interstitialis*
182. *Mycteroperca microlepis*
183. *Mycteroperca phenax*
184. *Mycteroperca* sp.
185. *Mycteroperca venenosa*
186. *Myripristis jacobus*
187. *Nicholsina usta*
188. *Ocyurus chrysurus*
189.**Odontoscion dentex*
190.**Ophioblennius atlanticus*
191. *Opsanus beta*
192. *Opsanus pardus*
193. *Opsanus* sp.
194. *Opsanus tau*
195.**Ostichthys trachypoma*
196. *Pagrus pagrus*
(Pagrus sedecim)
197. *Parablennius marmoreus*
198.**Paraclinus nigripinnis*
199. *Paraconger caudilimbatus*
200.**Paradiplogrammus bairdi*
201. *Paranthias furcifer*
202. *Parophidion lagochila*
203.**Pempheris schomburgki*
204.**Phaeoptyx conklini*
205. *Phaeoptyx pigmentaria*
206.**Phaeoptyx xenus*
207.**Plectranthias garrupellus*
208.**Plectrypops retrospinis*
209. *Pomacanthus arcuatus*
210. *Pomacanthus paru*
211.**Pomacanthus* sp.
212.*Pomacentridae
213.**Pomacentrus diencaeus*
214.**Pomacentrus fuscus*
215. *Pomacentrus leucostictus*
(Eupomacentrus leucostictus)
(Stegastes leucostictus)
216. *Pomacentrus partitus*
217. *Pomacentrus planifrons*
(Stegastes planifrons)
218. *Pomacentrus variabilis*
(*Stegastes variabilis*)
219. *Priacanthus arenatus*
220. *Priacanthus cruentatus*
221.**Priacanthus* sp.
222. *Pristigenys alta*
(*Pseudopriacanthus altus)*
223. *Pristipomoides aquilonaris*
224.**Pseudopriacanthus* sp.
225. *Pseudupeneus maculatus*
226. *Rhomboplites aurorubens*
227. *Risor ruber*
228. *Rypticus bistrispinus*
229. *Rypticus maculatus*
230. *Rypticus saponaceus*
231.**Rypticus* sp.
232.**Rypticus subbifrenatus*
233.**Scartella cristata*
234.**Scarus coelestinus*
235.**Scarus coeruleus*
236. *Scarus croicensis*
(*Scarus iserti*)
237.**Scarus guacamaia*
238.**Scarus taeniopterus*
239. *Scorpaena agassizi*
240.**Scorpaena albifimbria*
241.**Scorpaena bergi*
242. *Scorpaena brasiliensis*
243. *Scorpaena calcarata*
244. *Scorpaena dispar*
245.**Scorpaena inermis*
246. *Scorpaena plumieri*
247.**Scorpaenodes tredecimspinosus*
248. *Serraniculus pumilio*
249.**Serranus annularis*
250. *Serranus baldwini*
251. *Serranus notospilus*
252. *Serranus phoebe*
253. *Serranus subligarius*
254.**Serranus tabacarius*
255. *Serranus tigrinus*
256.**Sparisoma atomarium*
257.**Sparisoma chrysopterum*
258. *Sparisoma radians*
259.**Sparisoma viride*
260. *Sphoeroides spengleri*
261. *Starksia ocellata*
262.**Stathmonotus hemphilli*
263. *Tautoga onitis*
264. *Thalassoma bifasciatum*

list of all such higher categories that consist solely of hard-bottom obligates but are merely a reflection of specimens included in our data sets that were not identified beyond genus or family. Inclusion of such groups was recommended by Moser et al. (1995).

To prepare this list, we submitted a provisional list, which was also reviewed by colleagues with knowledge of Florida fishes, and we subsequently deleted all species for which any of these reviewers expressed serious objections. This process pared our additions down to 74 species, 15 genera, and 4 families. The final SEAMAP list for Florida now contains a total of 264 taxa names (Table 5); taxa added for the Florida segment are indicated by an asterisk. The names we have used or those we have listed as primary synonyms are those listed in the current American Fisheries Society list (Robins et al., 1991). Use of the added fish names in screening our collection data resulted in identification of a significant number of additional hard-bottom sites.

SPECIMEN COLLECTION FIELD DATA AND HARD-BOTTOM INVERTEBRATES

Data associated with the Florida Marine Research Institute (FMRI) Specimen Collection were examined for evidence indicating presence of hard-bottom habitat, or for no evidence of hard bottom. FMRI Specimen Collection field data and species-lot data are stored in a relational database, which we searched using the methods described below (See Florida Marine Research Institute, FL01-FL06, in Summary of Bottom Mapping Data Sources). In field surveys, assemblages of hard corals, octocorals, sponges, and hydroids observed or collected are clear evidence of the presence of hard bottom. Table 6 lists confirmed hard-bottom-obligate invertebrate species present in FMRI collections from the Florida study area.

GEOGRAPHIC INFORMATION SYSTEM METHODS

Hardware and Software. The GIS software package used was ARC/INFO 7.04 (ARC704) running on a Sun workstation using the Solaris 2.5 operating system. Additionally, significant data processing and compilation was accomplished using ArcView 3.0 running on the same system.

Construction of the Grid. A grid composed of one-minute by one-minute cells overlays this region to aid in data analysis. Initially, the grid used in the Florida SEAMAP project was the southern section of the grid established by the multi-state SEAMAP project that extended south of Cape Canaveral to 28^{o}N. During the course of data analysis, the SEAMAP region was extended southward to Jupiter Inlet, and it became necessary to create a new grid for the Florida SEAMAP region. ArcView 3.0 and ArcPlot were used to create Figure 2, which displays a rasterized version of the point, line, and polygon data. Bottom type is assigned to each grid cell for which there are data, based on the following hierarchy: 1) HB, AR, and HA, 2) PH and 3) NH. The grid is geographically accurate at each 1-minute by 1-minute intersection.

Basic Processes. Each point and line data set compiled in this document was received in dBaseIV format with accompanying latitude and longitude coordinates in ASCII format. The

ASCII coordinates were used to create an ARC coverage that was joined with the corresponding dBaseIV file. The resulting ARC coverage (point or line) was then exported to ARC704, where it was examined for possible errors. Data that fell outside the defined survey area or otherwise appeared incorrect (transposed numbers) were checked with the original data source and either corrected or removed.

Table 6. List of invertebrate species collected from within the study area and having voucher specimens in the Florida Marine Research Institute Specimen Collection that are considered to be hard-bottom-obligate species.

Cladocera arbuscula	Scleractinian Coral
Cladocera debilis	Scleractinian Coral
Diploria clivosa	Scleractinian Coral
Isophyllia sinuosa	Scleractinian Coral
Lophogorgia cardinalis	Octocoral
Lophogorgia hebes	Octocoral
Lophogorgia miniata	Octocoral
Millepora alcicornis	Hydrozoan
Millepora complanata	Hydrozona
Oculina diffusa	Scleractinian Coral
Oculina varicosa	Scleractinian Coral
Phyllochaetopterus socialis	Polychaete
Phragmatopoma caudata	Polychaete
Scolymia sp.	Scleractinian Coral
Siderastrea radians	Scleractinian Coral

Using ARC/INFO, the data sets were appended to form one point and one line data set (coverage). Each point and line record (in that order) was assigned a unique identification number (**Uniq_id**) based on previous SEAMAP survey reports by Van Dolah et al. (1994) and Moser et al. (1995) (note below additonal processing of line data prior to assigning **Uniq_id**). The last **Uniq_id** in the previously existing database was 23,960; therefore, point and line records compiled in Appendix 1 are numbered from 23,961 to 43,847. Point and line data located on a boundary line between two grid cells resulted in coding the cell to the north and to the west.

Lines that cross more than one grid cell and are not derived from trawl or dredge data are divided into segments based on the one-minute grid, and each segment is assigned a **Block** number accordingly. In order to do this, the IDENTITY command in ARC704 was used to pass the **Block** number to the line coverage. This created a node at every intersection between a data line and the grid. The latitude and longitude for each of these nodes was then calculated using SHOW COORDINATE in ARC704 and passed to the attribute table for the line coverage.

The polygon data are assigned unique identification numbers in series with the point and line data. A total of 900 polygon records are compiled and assigned **Uniq_id** numbers 43,848 to 44,747. Additionally, polygon data are assigned **Block** numbers and **Uniq_id** numbers in the same manner as the point and line data. Consequently, a polygon that occurs within more than one grid cell will have more than one **Block** number and more than one **Uniq_id**.

Appendix 3 summarizes the number of occurrences of the different bottom types for all data for each cell. This summary was generated by running a FREQUENCY in ARC/INFO on the bottom types for each cell. The data table was then created using SAS programming language (SAS Institute, 1990). The areal percentage data presented for polygons in Appendix 4 were generated using the FREQUENCY command and the STATISTICS command to summarize polygon area for each cell. Addditional formatting of the table was done using SAS (SAS Institute, 1990)

<u>Data Maps</u>. The figures displaying the point and line data (Figures 4-9) were created in ARCPLOT and display a hierarchy of bottom types, with hard bottom at the top, followed by probable hard bottom and no hard bottom. Point and line records previously reported by Van Dolah et al. (1994) that fall within the Florida SEAMAP survey area are included on Figures 4-9 but are not included in our data analyses, the Appendices, or Figure 2 described above.

SUMMARY OF BOTTOM-MAPPING DATA SOURCES

The following describes the sources of the data acquired for inclusion in the final hard-bottom report, the types of data they provided, and how these data were adapted to the purpose of bottom-type mapping. The relatively inaccurate data from early surveys that reported hard-bottom information, such as that derived from the first survey of hard-bottom habitats in Florida coastal waters (Moe, 1963) or data derived from May et al. (1971) and May et al. (1972), were not used; however, original data from the latter two sources, which we could not locate, might prove to be useful.

<u>Continental Shelf Associates, Jupiter, Florida, for USACOE</u>

Data were originally acquired from Continental Shelf Associates (CSA) as paper copies of reports and converted to Arc-Info data sets. Detailed coordinates for corners of the sites surveyed in CA02 and CA03 were subsequently obtained from the U.S. Army Corps of Engineers, Jacksonville District, and the U.S. Environmental Protection Agency, Region 4, Atlanta, Georgia. An ArcInfo data set for CA04 was obtained from CSA.

CA02: A field survey of a proposed offshore dredged material disposal site, where extensive hard bottom was found, and a candidate offshore dredged material disposal site, which contained no hard bottom, in the vicinity of the Fernandina Harbor area (Continental Shelf Associates, Inc., 1986). The disposal sites were sampled using SCUBA, video, and fathometer to determine bottom type (34 polygons).

CA03: A field survey of two offshore dredged material disposal sites in the vicinity of Canaveral Harbor provided areal data (Continental Shelf Associates, Inc., 1987). The sites were sampled using SCUBA, video, and fathometer to determine bottom type (16 polygons).

CA04: A nearshore side-scan sonar and hydrographic survey of a beach nourishment site in Brevard County provided areal data (Continental Shelf Associates, Inc., 1994). Unmapped nearshore hard bottom amounting to 50-100 acres occurs from Patrick Air Force Base south to just north of Indialantic (43 polygons).

U.S Army Corps of Engineers, Jacksonville District (USACOE)

CE03: The Jacksonville District's vibracore database of samples taken from 1973 through 1994 (434 records).

CEXX: Currently, we have data on hand provided by the USACOE, Jacksonville Office, on hard-bottom habitat off Dade, Broward, and Palm Beach counties. The data were collected during the ongoing Coast of Florida Erosion and Storm Effects Study, which is being funded by the Corps and the Florida Department of Environmental Protection's Bureau of Beaches and Coastal Systems. The data were collected during a side-scan sonar mapping survey by Continental Shelf Associates, Inc. (1993a, 1993b, and 1993c). We have included the data within the Florida study area in the Appendices (392 polygons) and have provided a series of maps showing the bottom types determined in the area surveyed, but it will be necessary at this time for SEAMAP participants and others to request the data directly from the USACOE, Jacksonville Office. Depending on the availability of funds, the State and the Corps are planning to continue the study in the area between the Palm Beach-Martin County line and Cape Canaveral.

U.S. Environmental Protection Agency, Region 4, Atlanta (USEPA)

EP03: A side-scan sonar survey of the Jacksonville Harbor Ocean Dredged Material Disposal Site, 1995 (4 polygons).

EP04: A video survey of the Fort Pierce Harbor Ocean Dredged Material Disposal Site, 1991 (2 polygons).

Florida Marine Research Institute, St. Petersburg (FMRI)

Data for voucher specimens and all pertinent field data from several past projects conducted by the Florida Marine Research Institute (formerly Florida Department of Natural Resources, Marine Research Laboratory) and from other (non-FMRI) sources are archived in a database associated with the FMRI Specimen Collection. Field data and species-lot data, stored in a relational database, were searched using the following methods. We made two searches of the database after preliminary investigations of its contents. Prior to the first search, we identified the following key words in the field-data file that could be used to identify samples from hard-bottom sites: coral, live, hard, reef, ledge, pinnacle, limestone, coquinoid, sponge, *Phragmatopoma, Phyllochaetopterus, Oculina,* and Sabellariidae. We also inspected field-data records to identify those that were not pertinent to this study (e.g., records based on the key terms listed above that proved to be erroneous, samples from the Indian River Lagoon, or those taken by inappropriate gear, e.g., a plankton net), and we eliminated them from further searches. We then printed a list of all invertebrate species in the Specimen Collection that were captured from within the study area and inspected the list for hard-bottom indicator species (Table 6).

In the first search of the database, we examined only the field-data variables for the key terms listed above that indicate the type of bottom from which the sample was taken; during the second search, we examined species-lot data for hard-bottom obligate fishes and invertebrates using those listed in Tables 5 and 6. We concatenated results from the searches and eliminated duplicate records, i.e., those with duplicate original collection numbers. Finally, we analyzed the data on fishes recorded on field data sheets during the SEAMAP East Coast Benthic Faunal Mapping Study (FL05, below) using standard SEAMAP protocol for hard-bottom obligate fishes listed in Table 5, and we updated the records to higher bottom-type classifications as indicated by the fish data. Only a few records required updating, suggesting that bottom-type determinations made from the collection records data and the hard-bottom obligate fish data are consistent.

Data from east Florida in the FMRI Specimen Collection database are from the following sources.

FL01: Federal Clam Project, an exploratory survey for clams conducted by FMRI during 1968-1971 under a grant from the National Marine Fisheries Service (PL88-309, Project No. 2-134-R) using a Nantucket hydraulic clam dredge; only data from survey area IV (Godcharles and Jaap, 1973: Fig. 1) were used (13 records).

FL02: Rock Shrimp Project, a life-history study and exploratory fishing survey of rock shrimp (*Sicyonia brevirostris*) populations off the Florida east coast conducted by FMRI during 1973-1974 under a grant from the National Marine Fisheries Service (PL88-309) (Kennedy et al., 1977). A semi-balloon otter trawl with 2.5-cm stretch mesh and a 6.5-m head line was used at four life-history study sites off Cape Canaveral. A semi-balloon otter trawl with 5.1-cm stretch mesh and a 6.7-m head line was used at 163 exploratory fishing stations located between the Florida-Georgia border and St. Lucie Inlet, Florida. A Shipek bottom grab was used to study diet-item availability at the four stations off Cape Canaveral (446 records).

FL03: Hutchinson Island Nuclear Power Plant Environmental Study, a marine environmental baseline study conducted by FMRI offshore of the site of the Florida Power and Light Company (FPL) St. Lucie nuclear-powered electricity-generating plant at Hutchinson Island, Florida, during 1971-1974 under a grant from FPL (Gallagher and Hollinger, 1977). Benthic samples were taken at five offshore sites using a Shipek bottom grab and a 3.7-m semi-balloon otter trawl with 2.4-cm stretch mesh on the wings and 1.8-cm stretch mesh on the cod end (405 records).

FL04: St. Lucie Power Plant 316a Study, a study after the plant's start-up conducted by Applied Biology, Inc., at the FPL nuclear power plant at Hutchinson Island for five years using protocols established by FMRI (see FL03). Only those sample data associated with voucher specimens donated to the FMRI Specimen Collection are recorded in the database (54 records).

FL05: SEAMAP East Coast Benthic Faunal Mapping Study, a macroinvertebrate inventory program conducted by FMRI during 1983-1985 and 1987 using ship time sponsored by the NOAA/SEAMAP program for the purpose of detecting zones of faunal similarity off the east coast of Florida. An 8-ft scallop tumbler dredge was used on 29 east-west transects between the Florida-Georgia border and St. Lucie Inlet, Florida, and several supplementary stations were sampled on the shelf using a 40-ft otter trawl (255 records).

FL06: Miscellaneous Records in the FMRI Specimen Collection Database, field-data and species-lot records associated with voucher specimens donated to the Specimen Collection from a variety of sources other than the sampling projects identified above. Many gear types are represented, including those in Appendix 1 that are not listed above. Only records having latitude-longitude coordinates were included (160 records).

Florida Dept. of Environmental Protection, Office of Fisheries Management and Assistance Services, Tallahassee (OFMAS)

FL07: A database of official records maintained by OFMAS of artificial reefs constructed with use of state or federal grants administered by that office (63 records).

Indian River County - Sebastian Inlet Taxing District

FL08: An ArcInfo database of the nearshore benthic habitat off Indian River County and a small region of southern Brevard County mapped by FMRI staff performing stereo photo interpretation on 1:7,200 scale natural color aerial photography by Aero Map U.S., Inc., Ormond Beach, Florida, taken July 1994. The photography was funded by the Indian River County and the Sebastian Inlet Taxing District. The resulting maps (149 polygons) show the coquinoid rock reef, or the Florida sabellariid reef, as an essentially continuous, broad (up to about 1/2-mile wide) feature extending from just north of Sebastian Inlet southward to beyond the Indian River-St. Lucie county line. Due to turbid conditions, no data could be compiled for an area off Vero Beach.

Miscellaneous Databases, Mostly Reporting Artificial Structures

FL09: A database associated with the "Atlas of Artificial Reefs in Florida, Fourth Edition," Florida Sea Grant College Program SGEB 20 (Pybas, 1991) (69 records). These data, as well as almost all other artificial reef data included in the database from Florida (see FL10 and FL11, below), were confirmed by volunteer divers trained by Florida Sea Grant staff (see Halusky, 1991) and are considered to be sufficiently accurate to include without qualification in the bottom-mapping database.

FL10: A database containing Loran TD information on artificial reefs and natural hard-bottom habitat, compiled from information provided by county governments, port authorities, other county groups, the Florida Oceanographic Society, Inc., and the OFMAS newsletter "Reef Report" (32 records).

FL11: A database containing GPS coordinate information on artificial reefs compiled from information provided by county governments, port authorities, other county groups, the Florida Oceanographic Society, Inc., and the OFMAS newsletter "Reef Report" (47 records).

Florida Institute of Technology, Melbourne (FIT)

FT01: Several thousand kilometers of continuous seismic records from the east coast of Florida were obtained from the U.S. Army Corps of Engineers Inner Continental Shelf Sediment and Structure (ICONS) study. These records were generated in the mid-1960's using Alpine Engineering 50 to 300 Joule sparkers as an acoustic signal source. Maps of the 11 study areas were duplicated from the Coastal Engineering Research Center (CERC) technical reports published in 1971 and 1975 (Meisburger and Duane, 1971; Meisburger and Field, 1975). The seismic records were then separated by location, and an inventory was created consisting of location, fix points, record number, line number, sweep rate, and date collected (10,381 records).

The maps of the study areas duplicated from the CERC manuals were photographically enlarged. Two points were strategically chosen on each map and were converted into the State Plane Coordinate System. This was accomplished by entering their original latitude and longitude into a coordinate conversion software program. These maps were placed on a 24" x 36" GTCO Digi-Pad 2436L digitizing board, which was calibrated using the two known State Plane Coordinate System points. A three-dimensional coordinate system in Autocad was used to digitize the northing and easting of the respective fix points of all seismic records reviewed for evidence of bottom type.

These files were then converted into latitude and longitude by Morgan and Eklund, Inc., Marine Surveyors.

The seismic records consisted of high-resolution and deep-penetration profiles separated by the bottom/water interface. Each record was individually analyzed for depth, relief, and bottom type. These parameters were recorded for each fix point on the seismic records. The depths were measured using a vertical scale determined by the speed of sound in water and sediment and the sweep rate of the analog recorder used to print seismic data. The relief was examined over an area with the fix point as a midpoint equidistant from the boundaries and categorized into low, medium, and high relief. The bottom type was determined by observing the change in seismic sounding returns, which is related to the geological structure of the sea floor and areas just beneath the sea floor. These structures were then classified by bottom type, and the data were entered into a spreadsheet in the format developed by the SEAMAP Bottom Mapping Workgroup.

The **Origcoll** code for this database is formed from a combination of an acronym for the map area and the FIT original collection number. The following identifies the map areas of the CERC study: SC, St. Augustine to Cape Canaveral; FL, Fort Lauderdale; SA, St. Augustine; FP, Fort Pierce; SJ, St. Augustine to Jacksonville; VB, Vero Beach; JK Jacksonville; CK, Cape Canaveral; JF, Jacksonville to Fernandina; FB, Fernandina Beach; and BB, Beverly Beach.

FT02: Vibracore samples, currently maintained at FIT, were taken at sites along the seismic lines surveyed for the FT01 database. A database of the cores was obtained from a previous study at Florida Institute of Technology on behalf of the Florida Geological Survey and the United States Mineral Management Service. The bottom types were determined by the descriptions given on the core sample sheets, and the data were converted into the SEAMAP format (295 records). The **Origcoll** code for this database is formed from a combination of an acronym for the map area described above and the CERC original collection number.

General Oceanographics, San Diego, California

GO08: A 1979 side-scan sonar study of OCS Lease Block 564 provided line data (63 records) (General Oceanographics, 1978), analyzed by Faisel M. Idris, Georgia Southern University, Applied Coastal Research Laboratory.

Harbor Branch Oceanographic Institution, Inc., Fort Pierce Florida (HBOI)

Data sets provided by HBOI (derived from trawl and dredge surveys, submersible surveys, sonar surveys, ROV surveys, diving surveys including lockout dives from submersibles, and other surveys) provide information on offshore benthic habitats for the area south of Cape Canaveral.

HB01: The data were compiled from the original cruise logs of dredge and trawl cruises conducted from 1973-1978 by HBOI scientists Robert H. Gore, Robert M. Avent, David Young, and Robert Virnstein. The logs indicated the time in and out of water, beginning and ending latitude and longitude, and depth. The dominant benthic species collected were identified. The data were scored for the presence of hard-bottom "identifier species." Identifier species were restricted solely to sessile, benthic species that require hard-bottom attachment. These included hard corals (scleractinians), gorgonians, hydroids, and sponges. The **Origcoll** code for this database is formed from the first letter of the HBOI ship name and the station number (251 records).

HB02: The data were compiled from the submersible photographic survey conducted by HBOI scientists Robert M. Avent, Frank K. Stanton, and John R. Reed (See Avent and Stanton, 1979). Data for this database were compiled from a set of computer printouts of the original data set. During the survey, the submersible traveled along an east-west path from a depth of 100 ft to 600 ft at a number of transect lines along the coast from Cape Canaveral to Jupiter, Florida. The scientist/observer in the submersible took random or haphazard photographs (2-4 per minute) as the submersible traveled close to the bottom. A measured grid was placed over each photograph on a microfiche viewer. Each photograph was scored for a variety of descriptors, including bottom type, dominant five species, hard bottom, latitude and longitude, and depth. These data were originally recorded in a computer database in the 1970's, but only the original hard copy of the computer printouts could now be used. The **Origcoll** code for this database is formed from the first letter of the HBOI ship name, the cruise number, and the station number (1122 records).

HB03: The data were compiled from written transcripts from the submersible survey conducted by HBOI scientists Robert M. Avent, Frank K. Stanton, and John R. Reed (See Avent and Stanton, 1979). These data were compiled from a set of written transcripts from dives conducted as described above in HBO2. An original written transcript is available for these dives, but either no photographs were scored or no photographs were available. The transcripts give depth, time, and description of the bottom, including the presence of hard bottom, ledges, and reefs. An original computer printout gives the latitude and longitude for actual times throughout the dives. The **Origcoll** code for this database is formed from the first letter of the HBOI ship name, the cruise number, and the station number (1113 records).

HB04: These data were compiled from original summary dive logs that indicated locations of reef sites from a SCUBA survey, including lockout dives from submersibles, conducted by HBOI scientists John R. Reed and John Hoskin. The data include the site determination, coordinates, and depth. The **Origcoll** code for this database is formed from the dive number or the first letter of the HBOI ship name, the cruise number, and the station number (71 records).

HB05: These data were compiled from cruises conducted from 1977 to 1978 by HBOI scientist John Thompson (See Thompson et al., 1979, for the results of part of this survey). For this report, a total of 69 side-scan sonar transects were analyzed. Data included original side-scan sonar printouts; corresponding fathometer printouts; and bridge logs, which recorded time (usually in 5-minute intervals), depth, Loran-C TD, and notes. Distance per transect ranged from 1.2 to 25 nmi. Approximately 417 nmi of east Florida continental shelf between Cape Canaveral and Jupiter Inlet were covered by these surveys. The Loran-C TDs were converted to latitude/longitude using the Andren Software Program. Hard bottom was determined by examination of both the side-scan sonar and fathometer printouts. The **Origcoll** code for this database is formed from the first letter of the HBOI ship name, the cruise number, and an arbitrary number (273 records).

HB06: These data were compiled from a cruise conducted by HBOI scientists Charles Hoskin and John R. Reed in 1981. Data consisted of fathometer printouts with log notes that recorded Loran-C TDs, latitude and longitude, depth of the base of each *Oculina* reef structure, depth of the top of each reef, and maximum relief. The original latitude and longitude records were used for this data set. A total of 25 *Oculina* reefs with relief of 6 to 88 feet were surveyed. The **Origcoll** code for this database is formed from the first letter of the HBOI ship name, the transect number, and an arbitrary number (39 records).

HB07: These data were compiled from cruises conducted by HBOI scientists Charles Hoskin and John R. Reed in 1982 using Harbor Branch Oceanographic Institution's Remotely Operated Vehicle (ROV) CORD. Data were originally noted from a video camera mounted on the ROV. Data consisted of notes on reefs, Loran-C, depth, and maximum relief. The Loran-C TDs were converted to latitude/longitude coordinates using the Andren Software Program. A total of 15 *Oculina* reef and hard-bottom structures with relief of 3 to 84 feet were surveyed. The **Origcoll** code for this database is formed from the first letter of the HBOI ship name, a concatenated ROV station number, and an arbitrary number (16 records).

<u>South Carolina Department of Natural Resources, Charleston</u> (<u>SCMRD</u>)

MR09: MARMAP point data for 1993-1995 from Chevron trap samples (6 records) were provided. The bottom types were determined based on fish species assemblages using standard SEAMAP protocols.

MR11: SEAMAP shallow-water trawl survey data for 1992-1994 (120 records) provided by SCMRD. The bottom types were determined based on fish species assemblages using standard SEAMAP protocols.

<u>Red Snapper Sink, NOAA NOS Chart 11480</u> (<u>NOS</u>)

NT01: One record of a location identified as a red snapper sink on the chart.

<u>National Marine Fisheries Service, Pascagoula</u> (<u>SEFSC</u>)

PA02: Data from bottom trawl and dredge surveys conducted during 1956-1987 (3,454 records) were provided by the NMFS/Southeast Fisheries Science Center, Pascagoula, Mississippi. Only the tow start locations were recorded; therefore, these data are points. We used standard SEAMAP protocols in analysing information on fish assemblages present to determine bottom type.

PA03: Data from bottom trawl surveys conducted during 1988-1994 (466 records) were provided. Both tow start and end locations were recorded, so these data are lines. We used standard SEAMAP protocols in analysing information on fish assemblages present to determine bottom type.

In addition, the SEFSC, in cooperation with the U.S. Geological Survey, Woods Hole, is mapping benthic habitat in the *Oculina* Bank Habitat of Particular Concern (HAPC), also called the Experimental *Oculina* Research Reserve (EORR), off Fort Pierce. The *Oculina* HAPC is part of an extensive band of pinnacles composed of living but mostly dead skeletons of *Oculina varicosa,* which extends an unknown distance north of Cape Canaveral, and a reference area in similar depths ESE of Cape Canaveral. The HAPC is a rectangular area of about 96 nm^2 enclosed within the following coordinates: NE 27º53'N, 79º56'W; NW 27º53'N, 80º00'W; SE 27º30'N, 79º56'W; and SW 27º30'N, 80º00'W. (We do not now have coordinates for the reference area.) When available, these data should be incorporated into the bottom-mapping database.

Sea Systems Corporation, Pompano Beach, Florida, for USACOE

SC01: A 1993 nearshore side-scan sonar and hydrographic survey conducted for beach nourishment in the northern half of Martin County (Sea Systems Corporation, 1993) provided areal data. The data, which show evidence of extensive hard bottom, were originally received from the USACOE as a CAD file and converted to ArcInfo (253 polygons).

SC02: A 1995 nearshore side-scan sonar and hydrographic survey conducted in St. Johns County (Sea Systems Corporation, 1994) provided areal data. Data showing no evidence of hard bottom were received in paper form from the USACOE and as a CAD file from Sea Systems Corporation (7 polygons).

Sport Fishing Publications

SP05: Diver-confirmed data from "Hot Spots" publication (The Jacksonville Scubanauts and The Jacksonville Offshore Sport Fishing Club, 1991) (177 original records). The document, currently out of print, was provided by Dr. A. Quentin White, Jacksonville University. According to Dr. White (pers. comm.), data for this publication

were acquired by trained, "parascientific" volunteers (see Halusky, 1991). the data were approved for inclusion in the database by the Bottom Mapping Work Group.

National Marine Fisheries Service (NEFSC)

WH01: Data from bottom-trawl surveys conducted by the NMFS/Northeast Fisheries Science Center, Woods Hole, MA (41 trawl records with only the tow set locations recorded). We used standard SEAMAP protocols in analysing information on fish assemblages present to determine bottom type.

RESULTS AND DISCUSSION

DATABASE COMPOSITION

The database that we compiled from 37 sources (Appendix 2) for the continental shelf off eastern Florida contains 20,787 records of points, line segments, and polygons (Appendix 1). Of the 37 sources, nine were areal surveys. An additional 910 point and line-segment records from 11 data sources (see the data dictionary for Appendix 2) were reported for Florida by Van Dolah et al. (1994), resulting in a total of 21,697 records for the study area. Most of our point and line records from off Florida were obtained by side-scan sonar gear (almost 11,000), dredges (3,304), bottom grabs (449), and trawls (1,873). Diver observations accounted for 246 records, and submersible observations represented 2,232 records. Fathometer surveys (HB06, 39 records) and an ROV survey (HB07, 16 records) accounted for a small but important number of records. Vibracore samples accounted for 729 records. Of these, data for 108 (1 in CE03 and 107 in FT02) showed evidence that they should not be classified as hard bottom (HB, PH) by SEAMAP criteria. These 108 records are included in the database (Appendix 1) but the field for the determination of bottom type is left blank and the records are not plotted on the detailed maps (Figures 4-9); all others are coded NH. Only six of our records were obtained by traps (MR09), and one record was obtained from a nautical chart (NT01). Most of the polygons were surveyed with combinations of gear (fathometer and video, bottom profiler and fathometer); however, in two studies (EP03 and EP04), the bottom was surveyed with only one type of gear. In one database (FL07, 63 records), the gear type is not recorded, but the data come from official records of construction of artificial reefs. We do not know the type of gear used or the type of confirmation used to determine the type and locations of bottom types for 113 records. One of these records is the single one from NT01, which records the location of a red snapper sink on a nautical chart; eight records were obtained from collection data for which the collection method or gear was not recorded; and the remainder were obtained from artificial reef information sources that were part of the records in FL09, FL10, and FL11). Indications are that the latter locations were confirmed by fishermen or divers using GPS or Loran C.

For the 20,787 new records in the Florida database, bottom type determinations are as follows: hard bottom (HB), 2,187 records; probable hard bottom (PH), 1,194 records; no evidence of hard bottom (NH), 16,984 records; artificial structures, 312 records; artificial structure and hard bottom (HA), 2 records; and no determination, 108 records (as noted above for vibracore samples). No jetties or buoys are recorded in the records of artificial structures. For the 910 records reported by Van Dolah et al. (1994) in the Florida study area (south of 30°44'N), 244 are reported as hard bottom, 299 are reported as probable hard bottom, and 367 are reported to have no evidence of hard bottom. The totals for the Florida continental shelf include 2,431 hard bottom records,

1,493 probable hard bottom records, 312 artificial structure records, 2 artificial structureand hard bottom records, and 17,351 records with no evidence of hard bottom.

MAPS SUMMARIZING BOTTOM-TYPE DETERMINATIONS

A geographical presentation of the grid cells coded by bottom type for the Florida study area is presented in Figure 2. Some determination of bottom type is recorded in the Florida database for approximately 37% of grid cells off Florida. The grid cells are coded to give priority to hard bottom or probable hard bottom versus no evidence of hard bottom. Of these, 713 are coded for hard bottom, 405 are coded for probable hard bottom, and 3,042 are coded for no evidence of hard bottom. The coding provides only general information of the distribution of hard-bottom habitat for the Florida portion of the study area.

Figure 3 provides an index of the maps that show a detailed geographical summary of the bottom-type determinations based on point and line data for Florida (Figures 4-9). Figure 10 provides an index to a second series of maps that show detailed information on the bottom-type determinations based on polygon data assembled for the Florida study area (Figures 11-15 and part of Figure 16). Finally, maps presented in Figures 16-19 show the bottom types determined in the USACOE-FDEP Coast of Florida Erosion and Storm Effects Study (database CEXX). Only the bottom-type determinations for the area north of 26°56'N are reported in the Florida database. All maps were prepared using ArcInfo as specified in the Geographic Information System Methods.

DISTRIBUTION OF BOTTOM TYPES ON THE FLORIDA SHELF

The relative distribution of bottom types determined from point and line data was examined in six approximately equal latitudinal regions of the Florida study area (Table 7). Overall, the highest percentage of hard-bottom plus probable hard-bottom

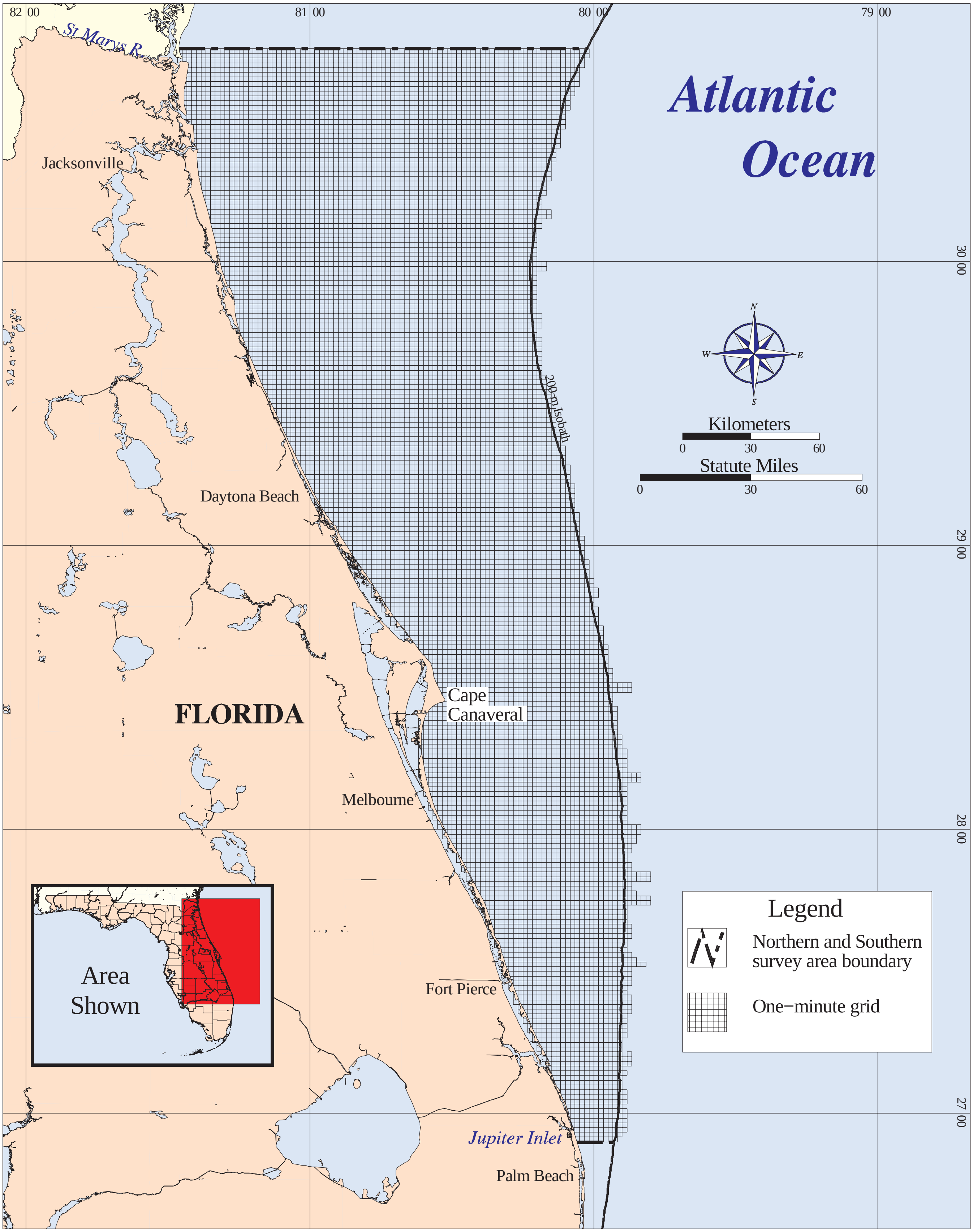


Figure 1. Extent of Florida SEAMAP survey area showing one−minute grid.

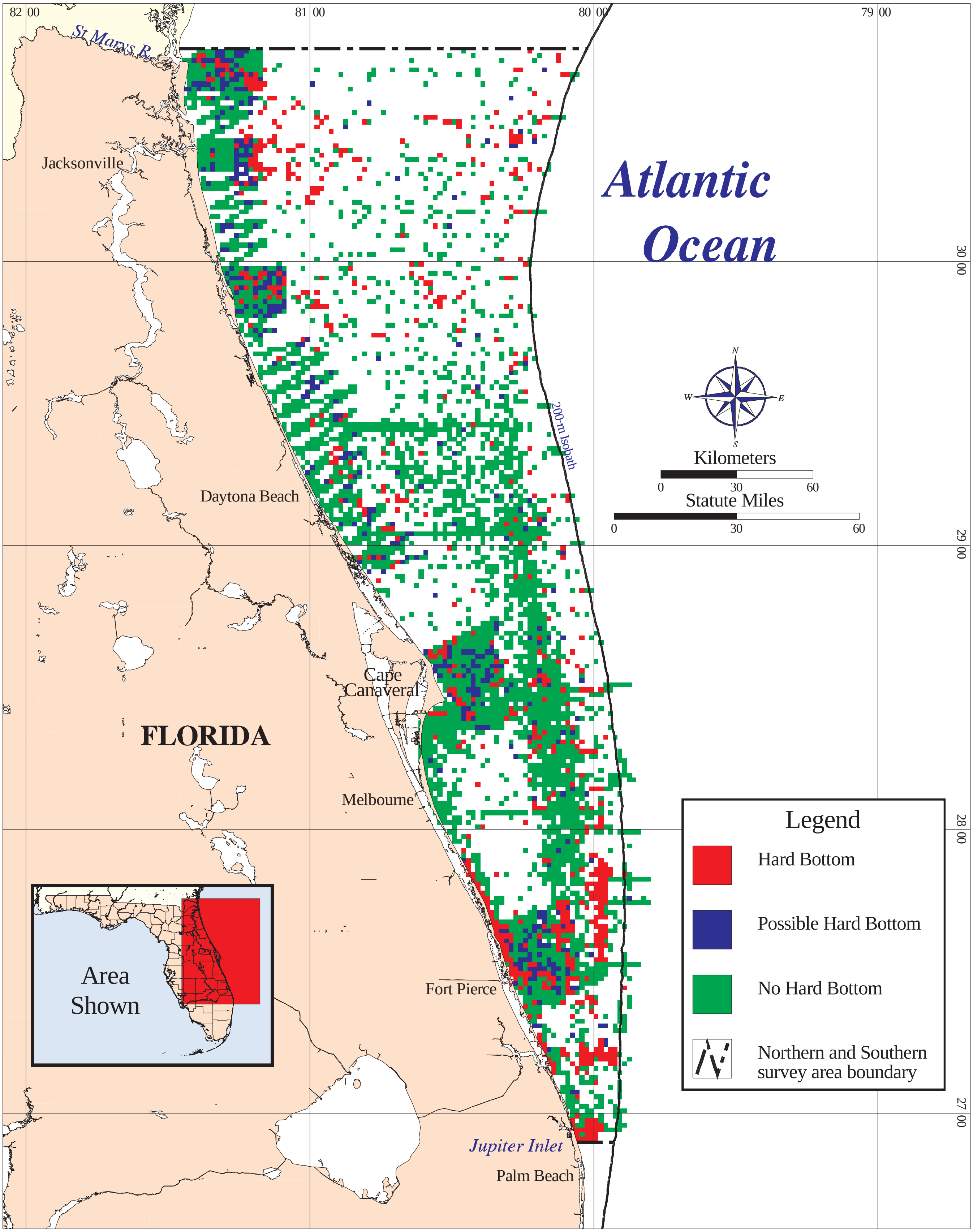


Figure 2. Distribution of grid cells in the Florida survey area that contain information on bottom type.

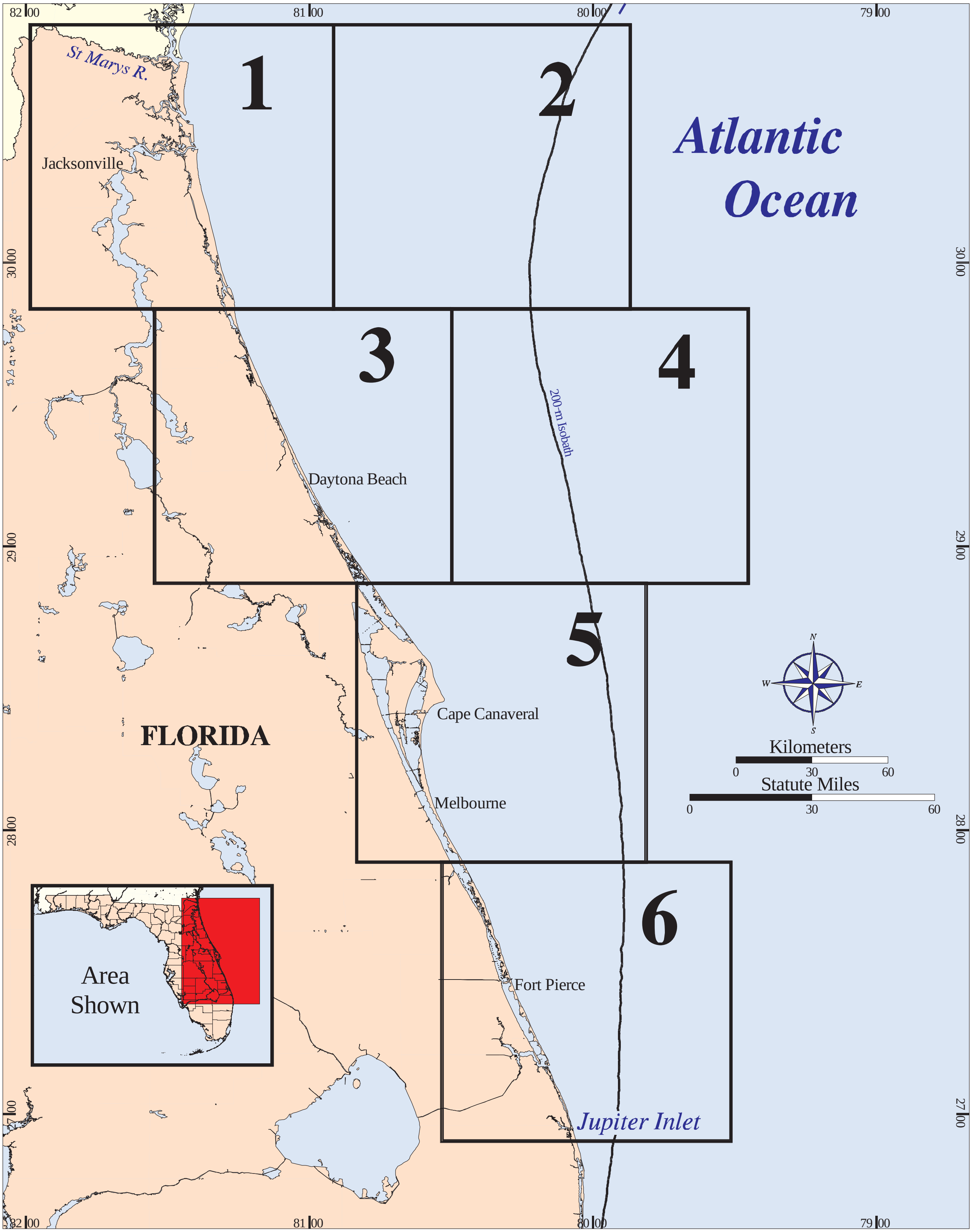


Figure 3. Index of Florida survey area divided into blocks to provide expanded detail of data in Figures 4 −9 (areas 1 −6).

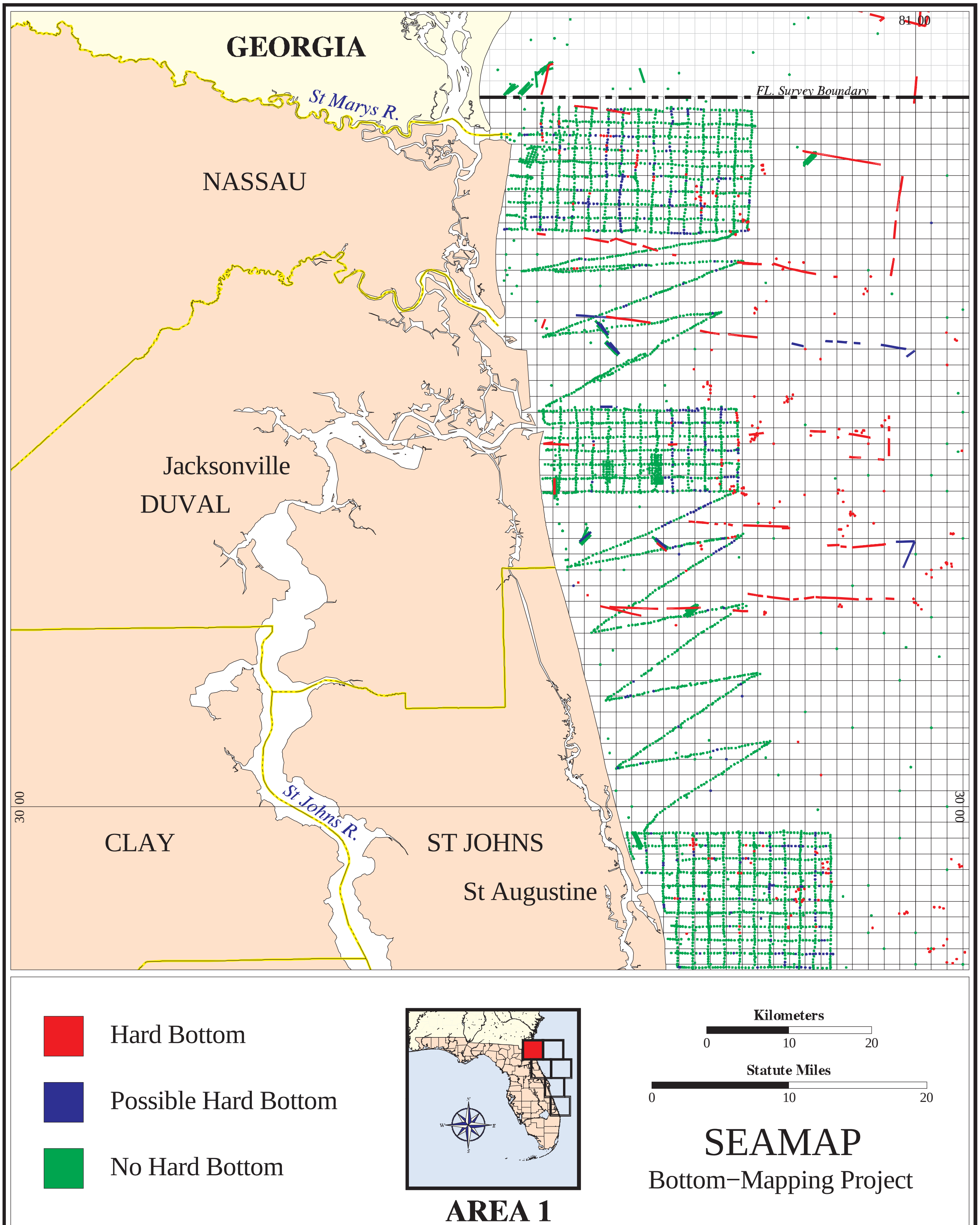


Figure 4. Location of point and line data that provide information on bottom type of the Florida survey area shown.

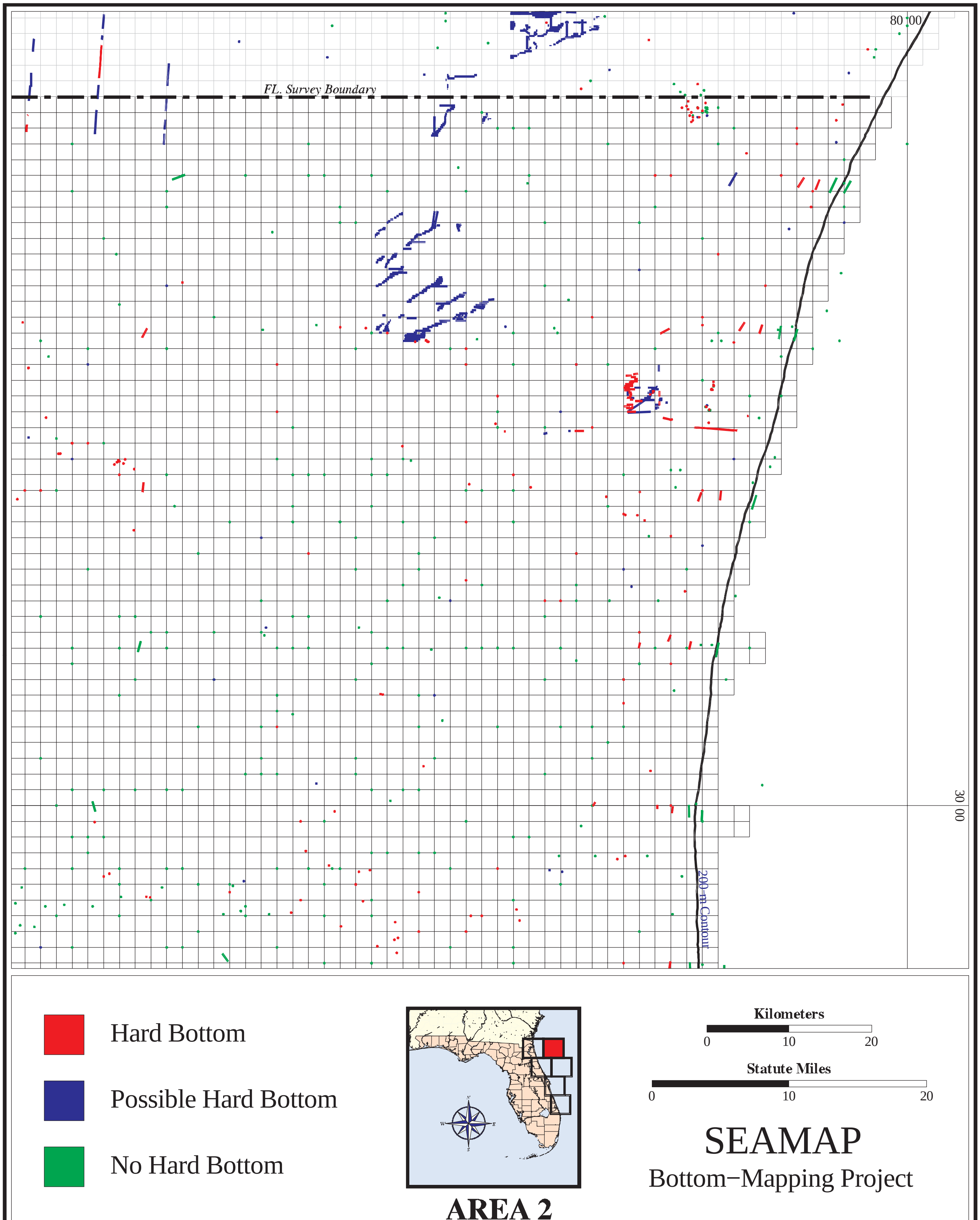


Figure 5. Location of point and line data that provide information on bottom type of the Florida survey area shown.

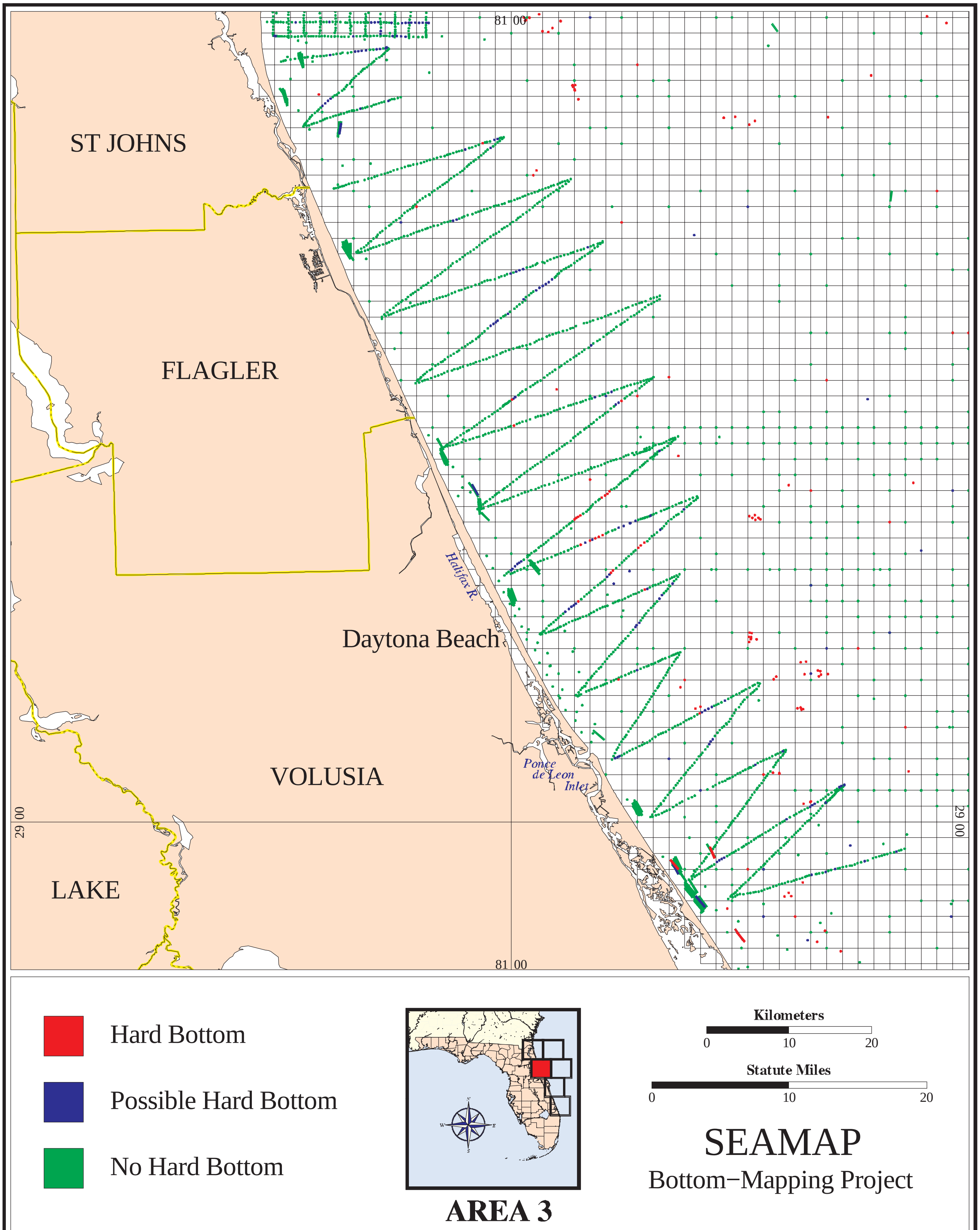


Figure 6. Location of point and line data that provide information on bottom type of the Florida survey area shown.

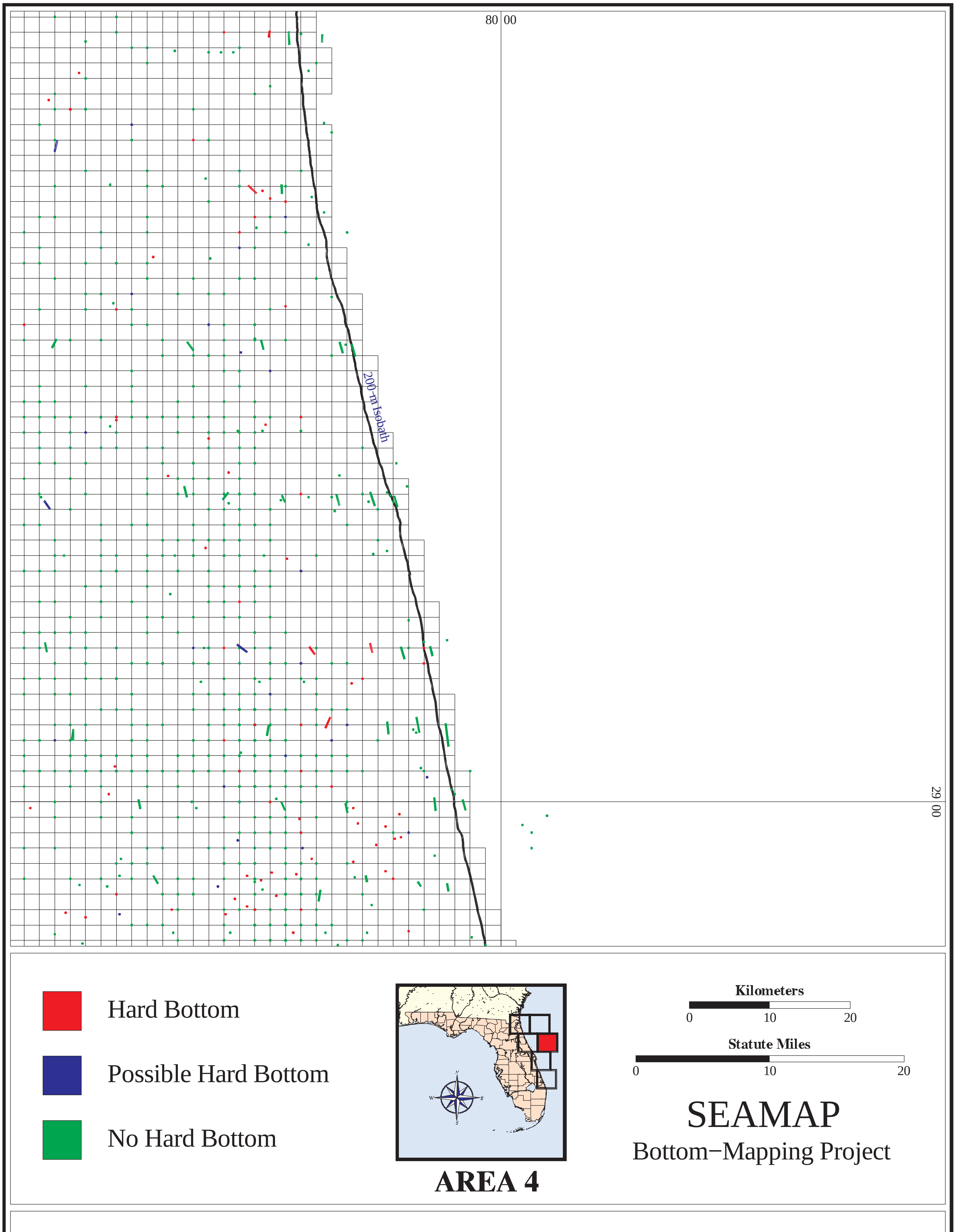


Figure 7. Location of point and line data that provide information on bottom type of the Florida survey area shown.

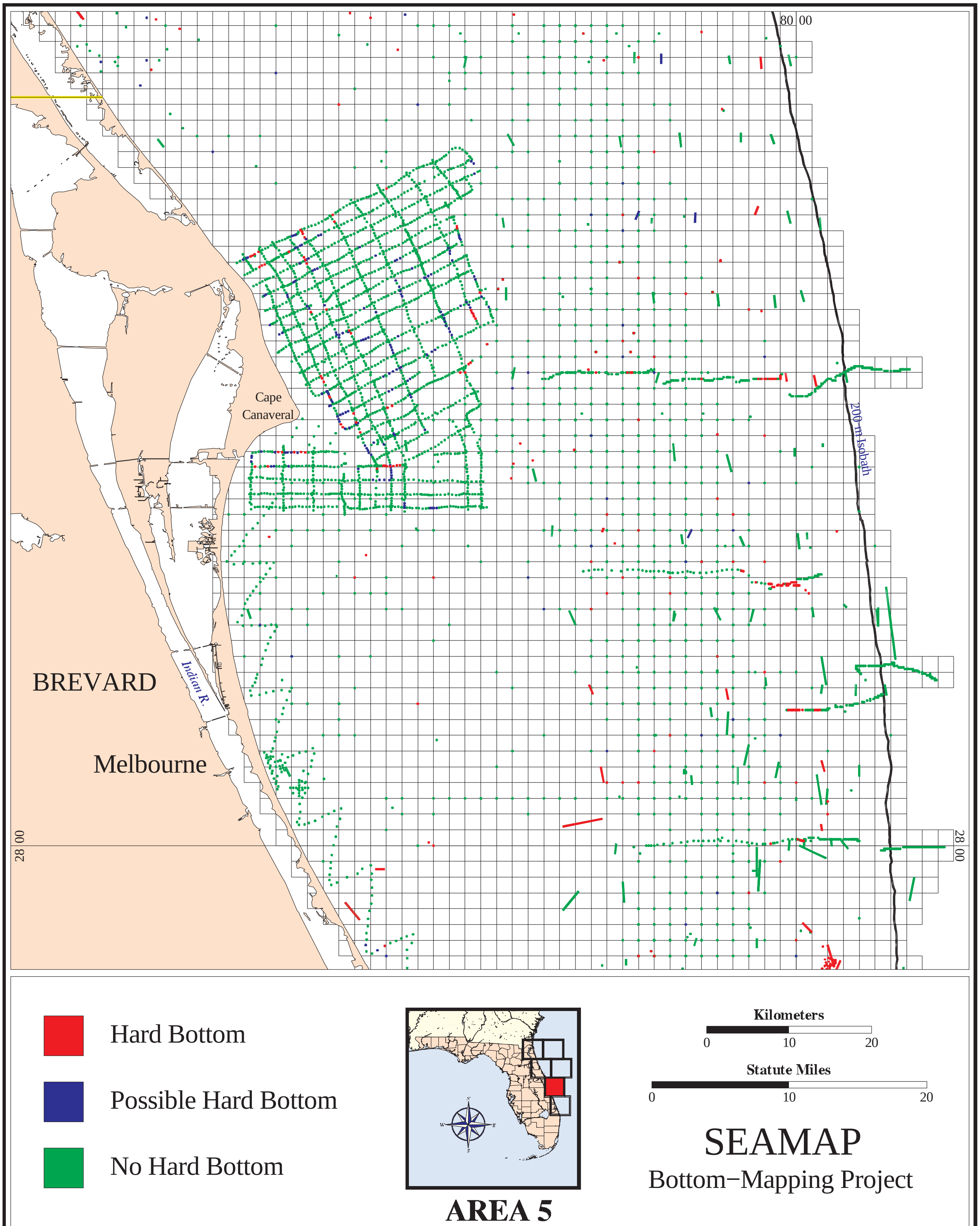


Figure 8. Location of point and line data that provide information on bottom type of the Florida survey area shown.

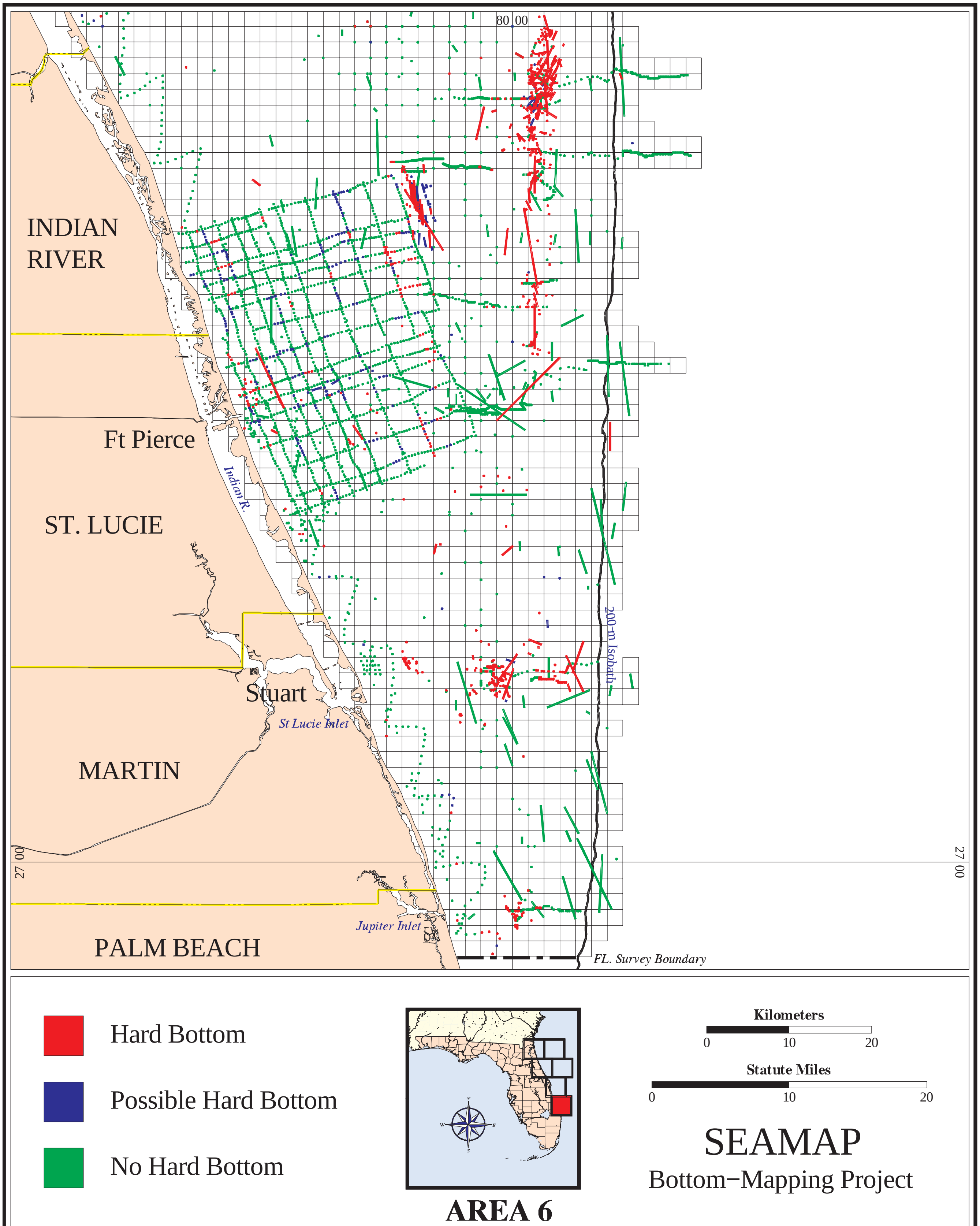


Figure 9. Location of point and line data that provide information on bottom type of the Florida survey area shown.

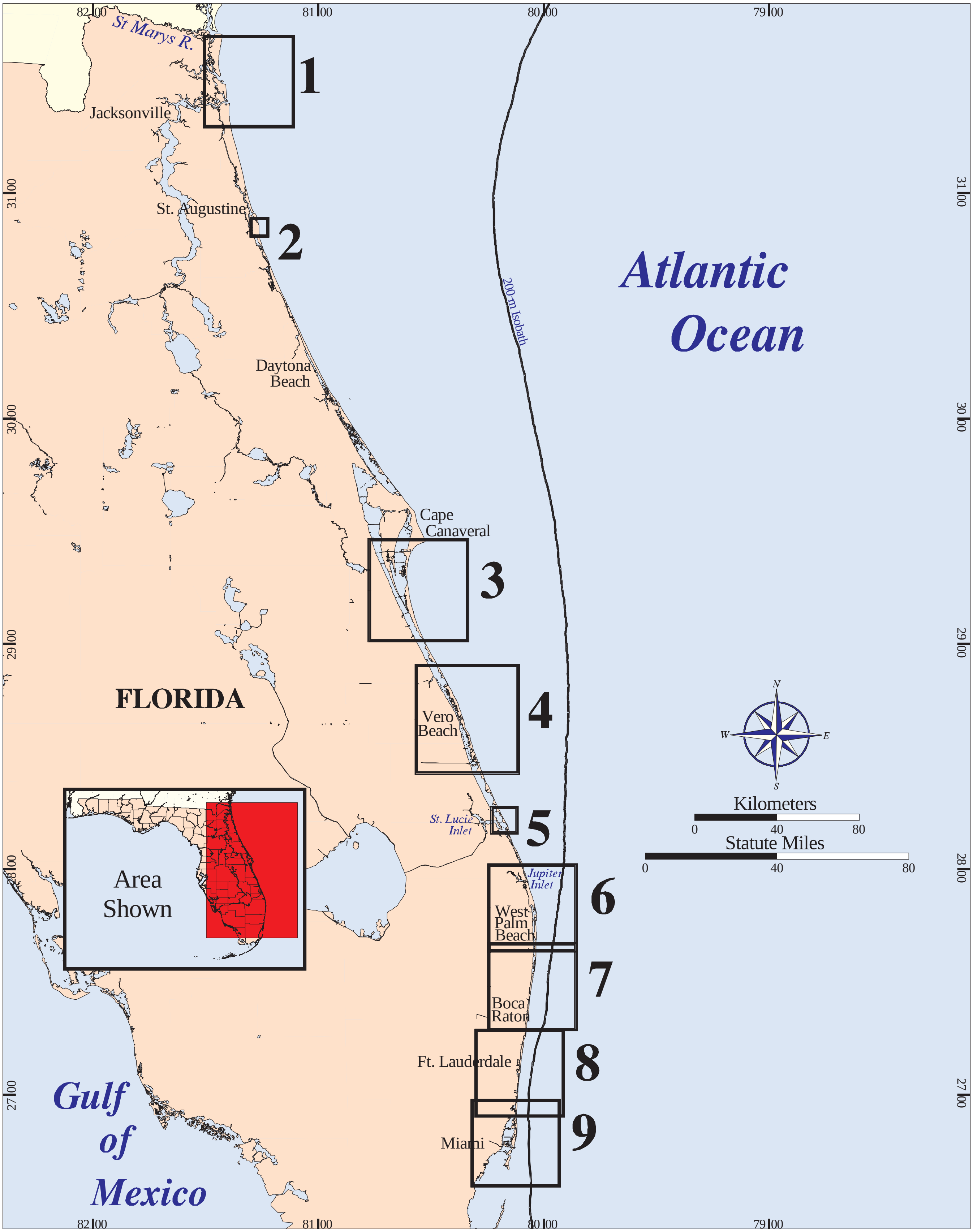


Figure 10. Index of Florida survey area divided into blocks to provide expanded detail of polygon data in Figures 11 −19.

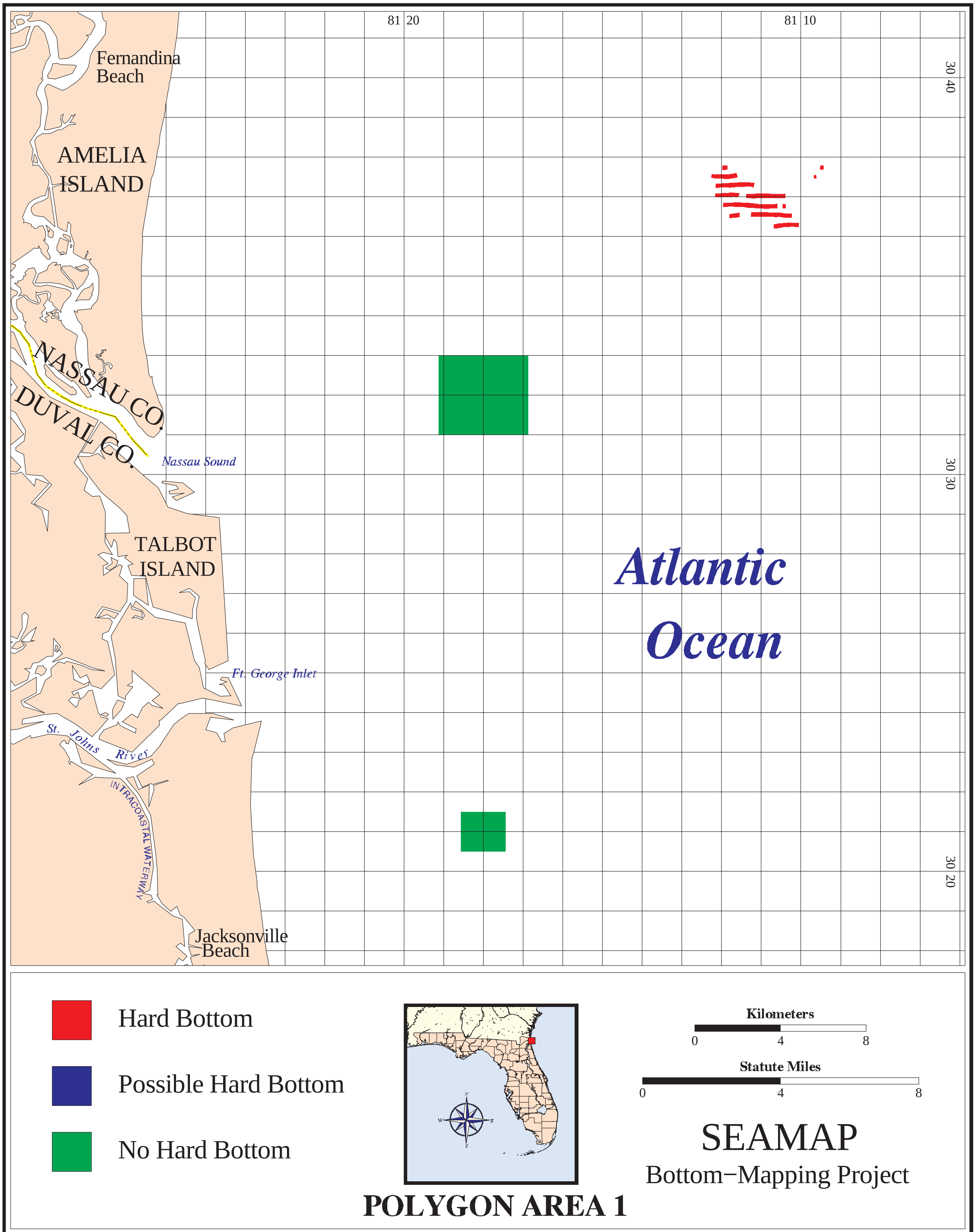


Figure 11. Detail of area from Amelia Island to Jacksonville Beach.

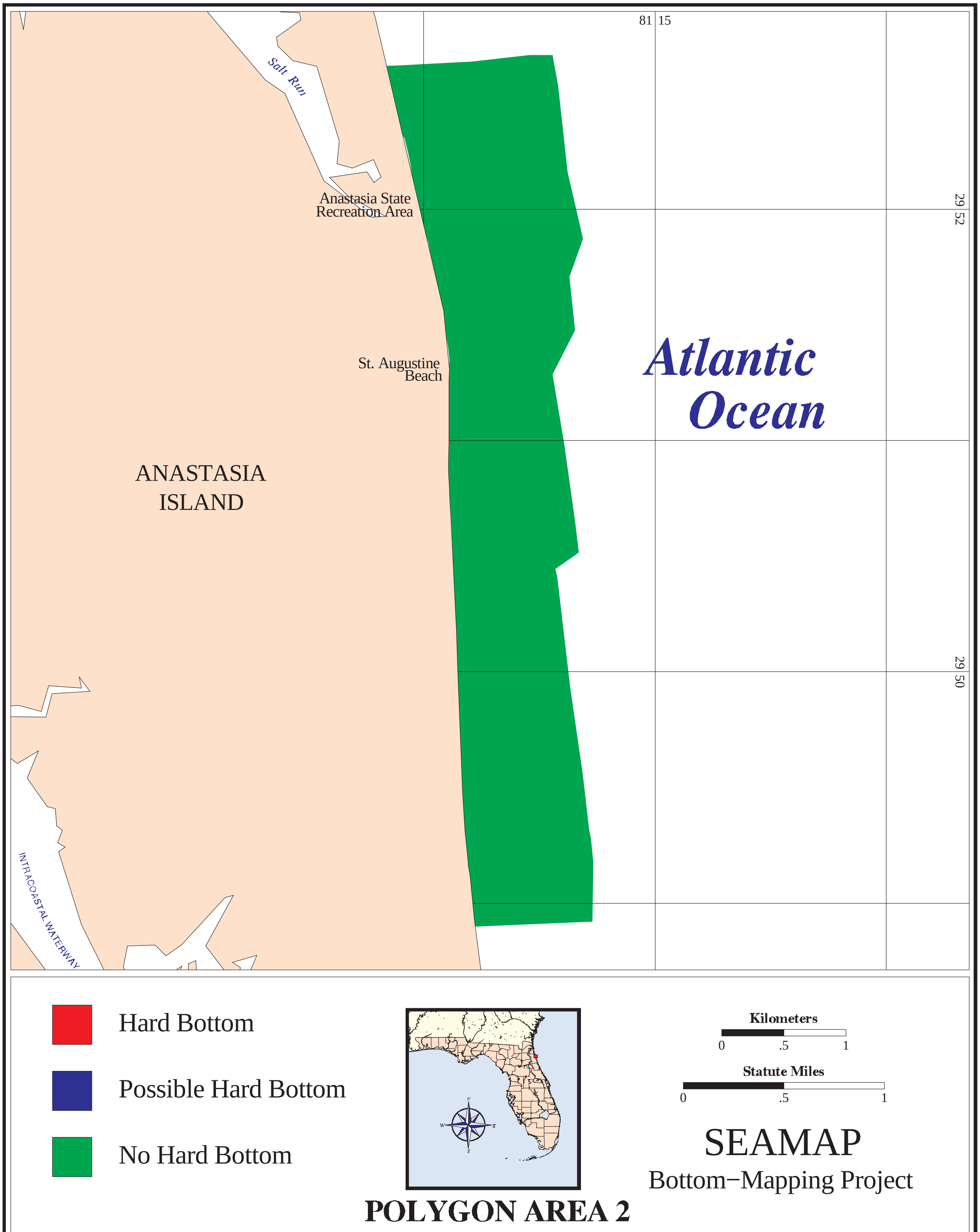


Figure 12. Detail of sidescan sonar data from St. Augustine Beach area.

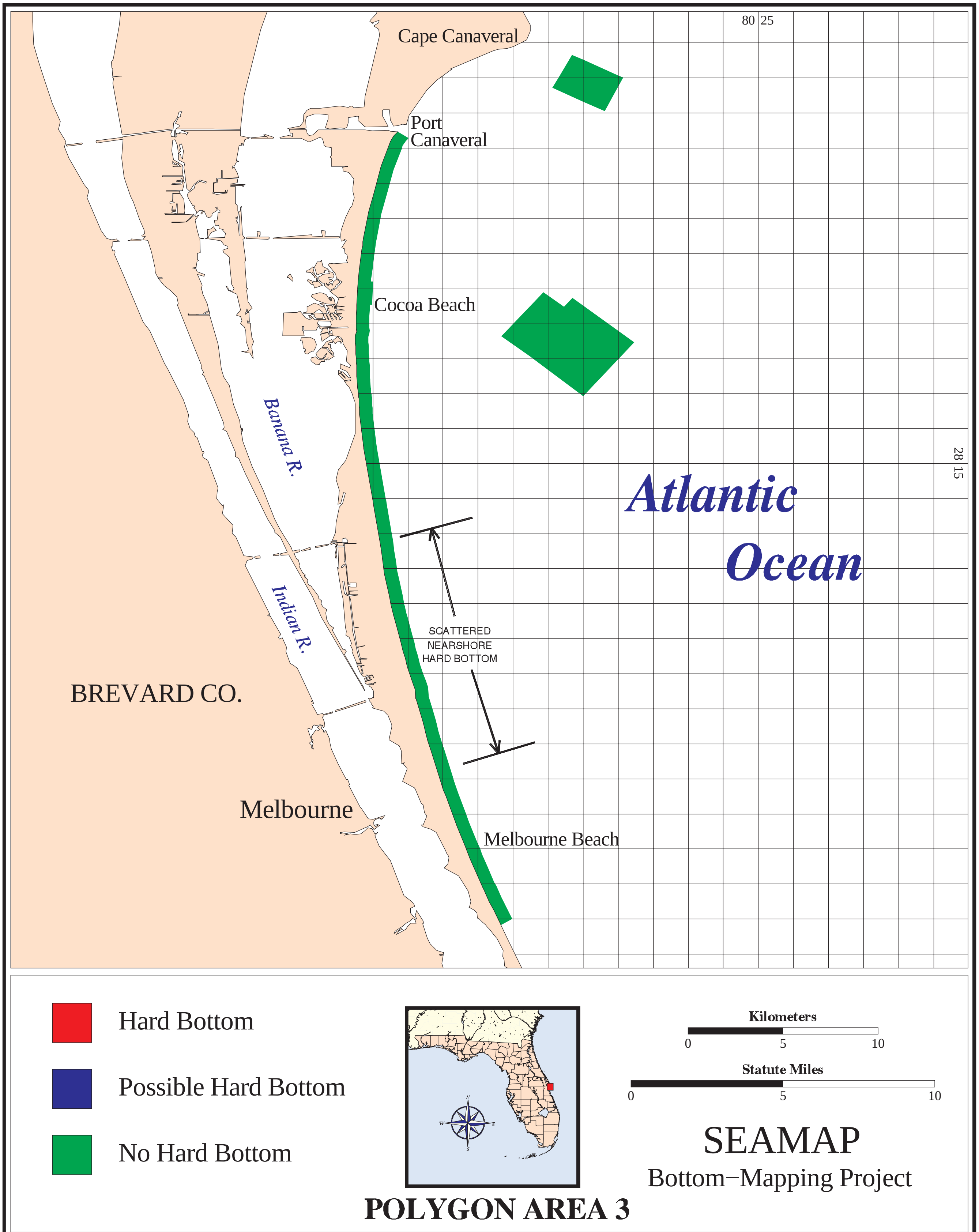


Figure 13. Detail of data south of Cape Canaveral; Brevard County.

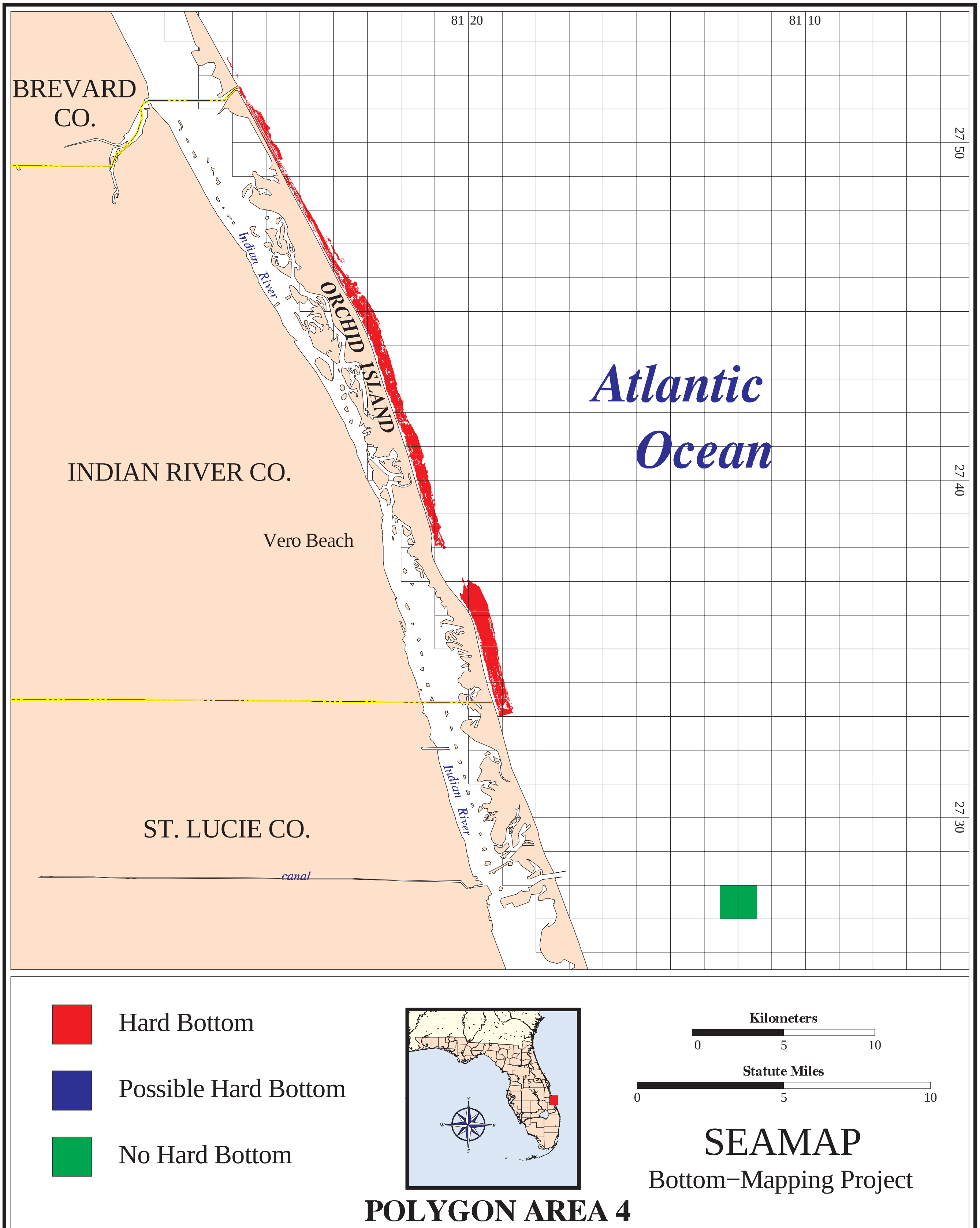


Figure 14. Detail of data from Brevard, Indian River, and St. Lucie counties.

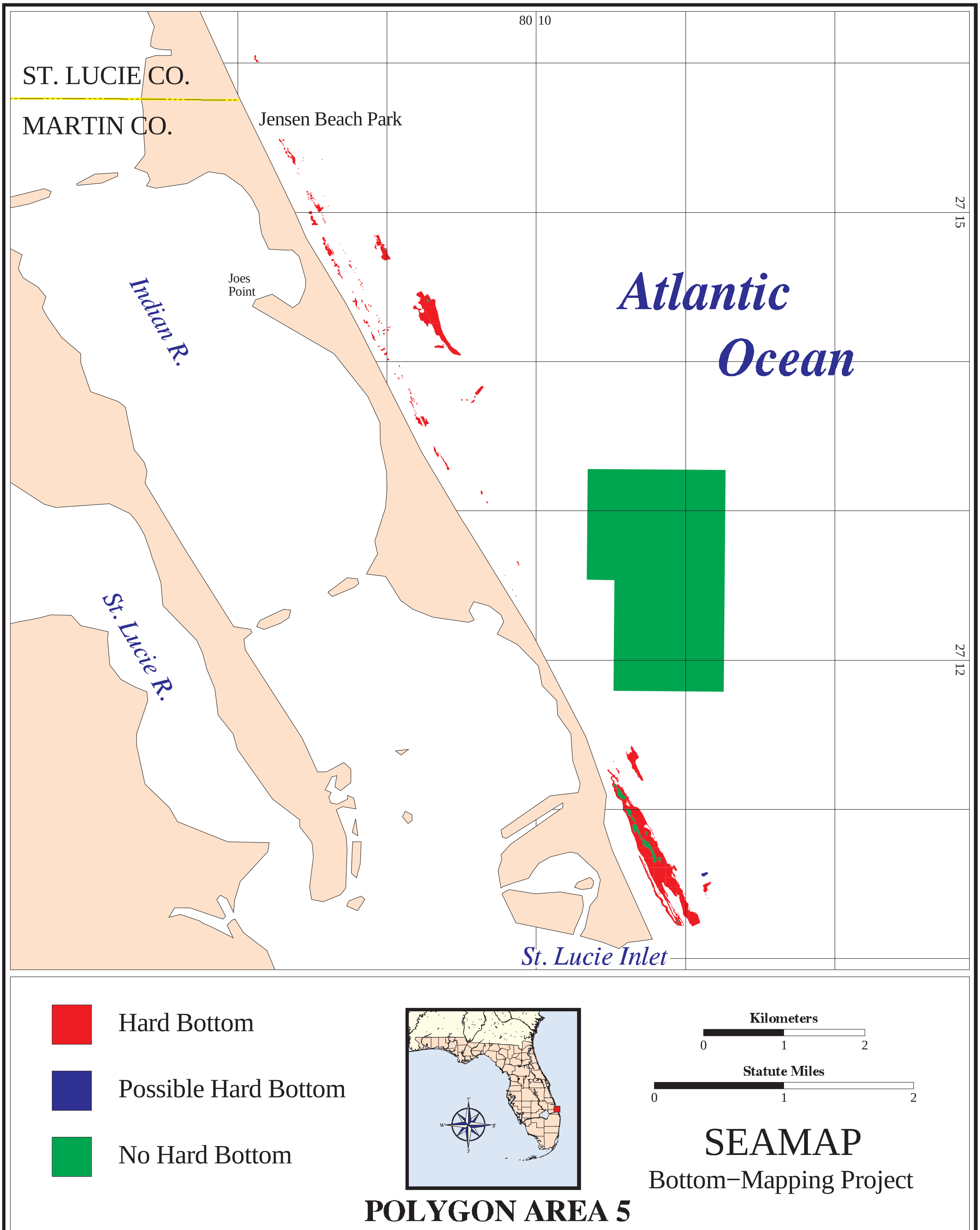


Figure 15. Detail of off−shore area just north of St. Lucie Inlet.

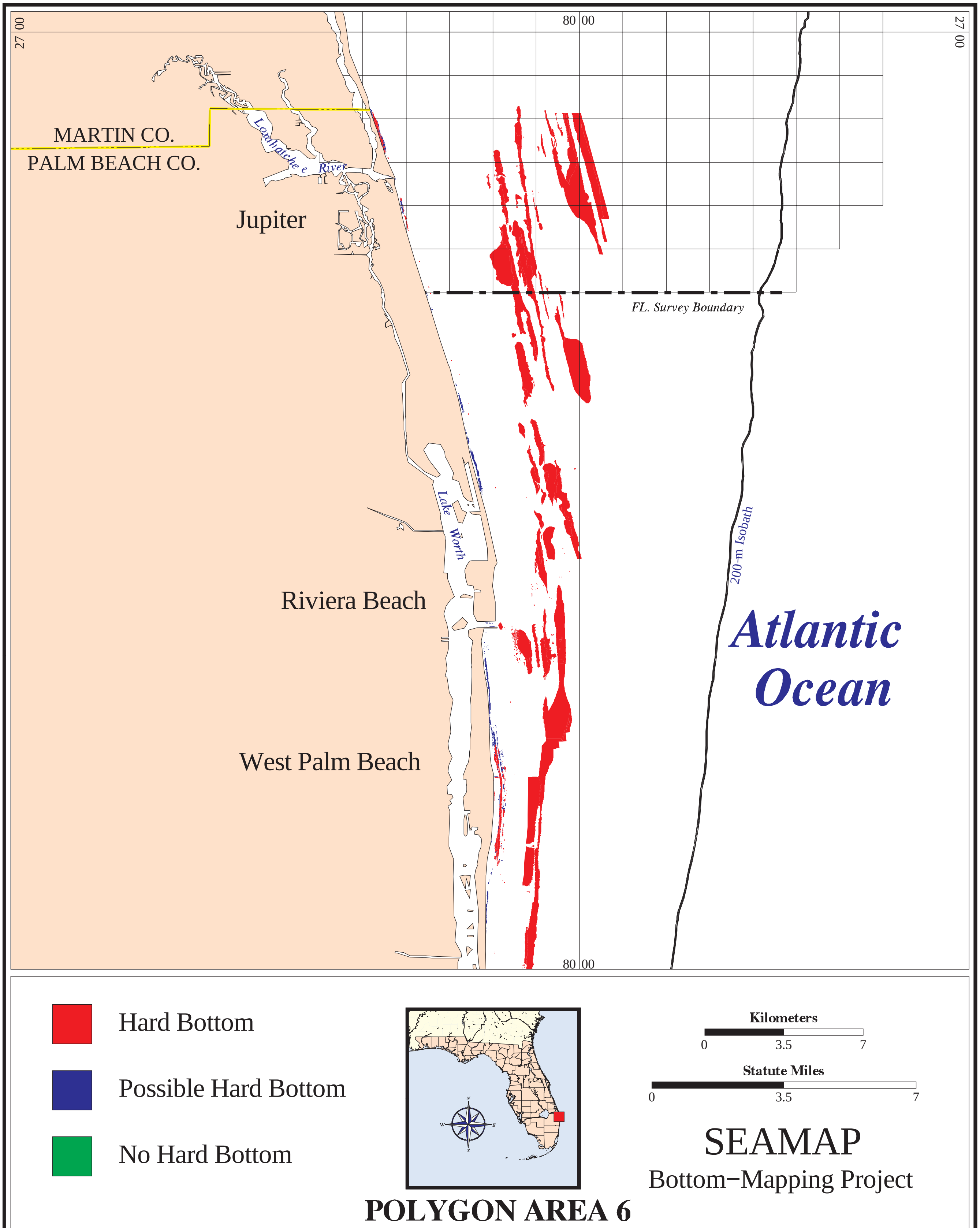


Figure 16. Data from Coast of Florida Erosion & Storm Effects Study; Northern Palm Beach County.

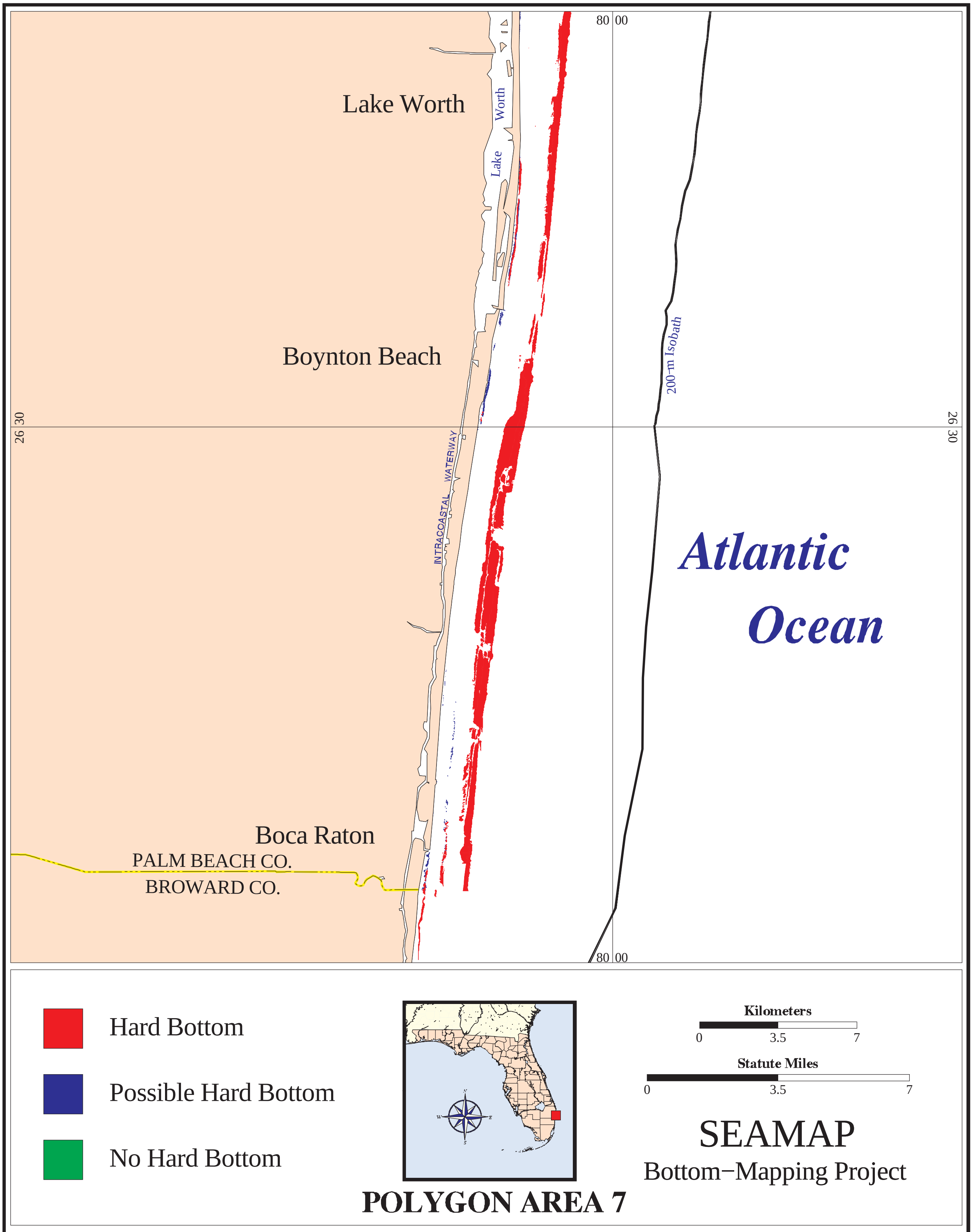


Figure 17 . Data from Coast of Florida Erosion & Storm Effects Study; Southern Palm Beach County.

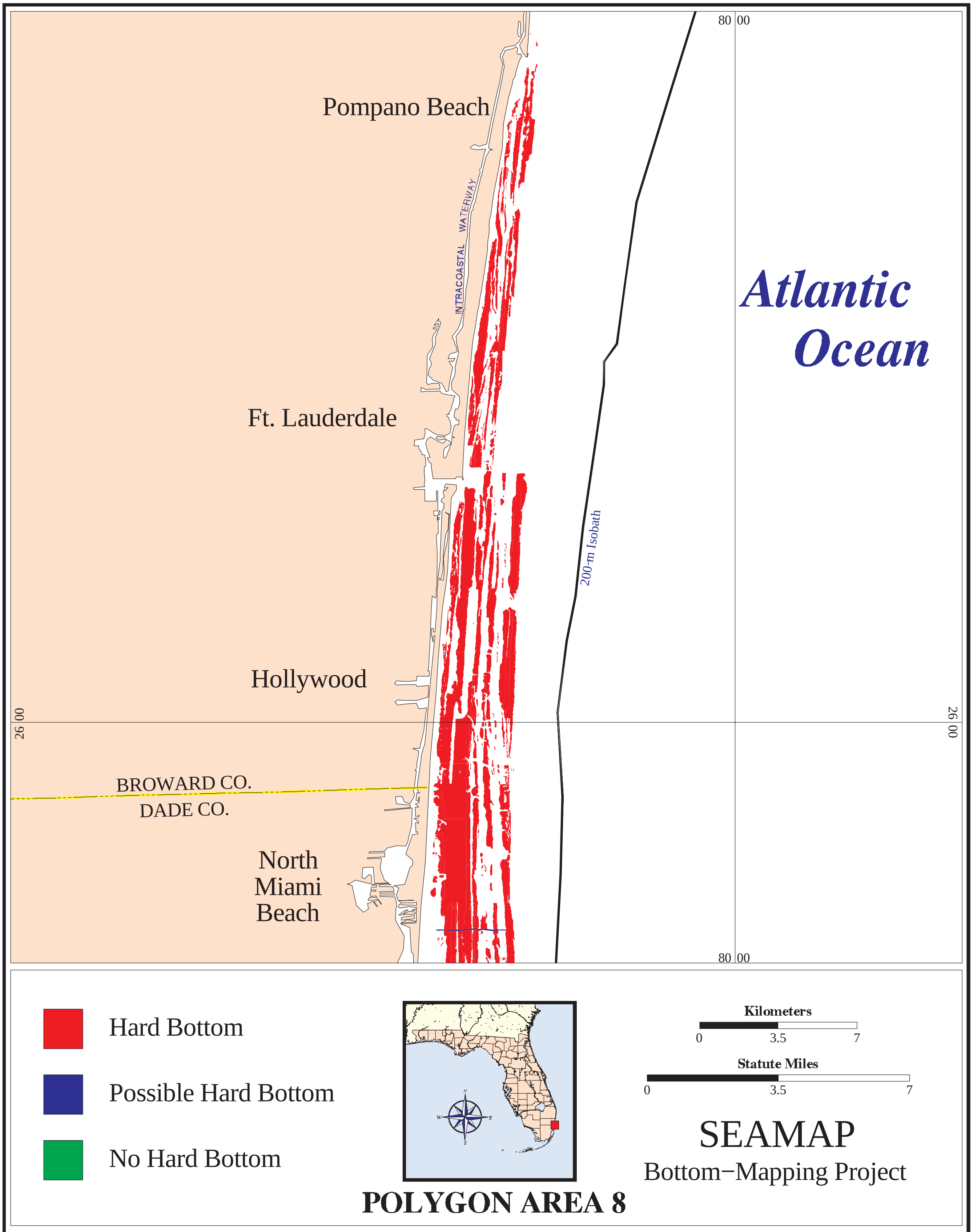


Figure 18 . Data from Coast of Florida Erosion & Storm Effects Study; Broward and northern Dade counties.

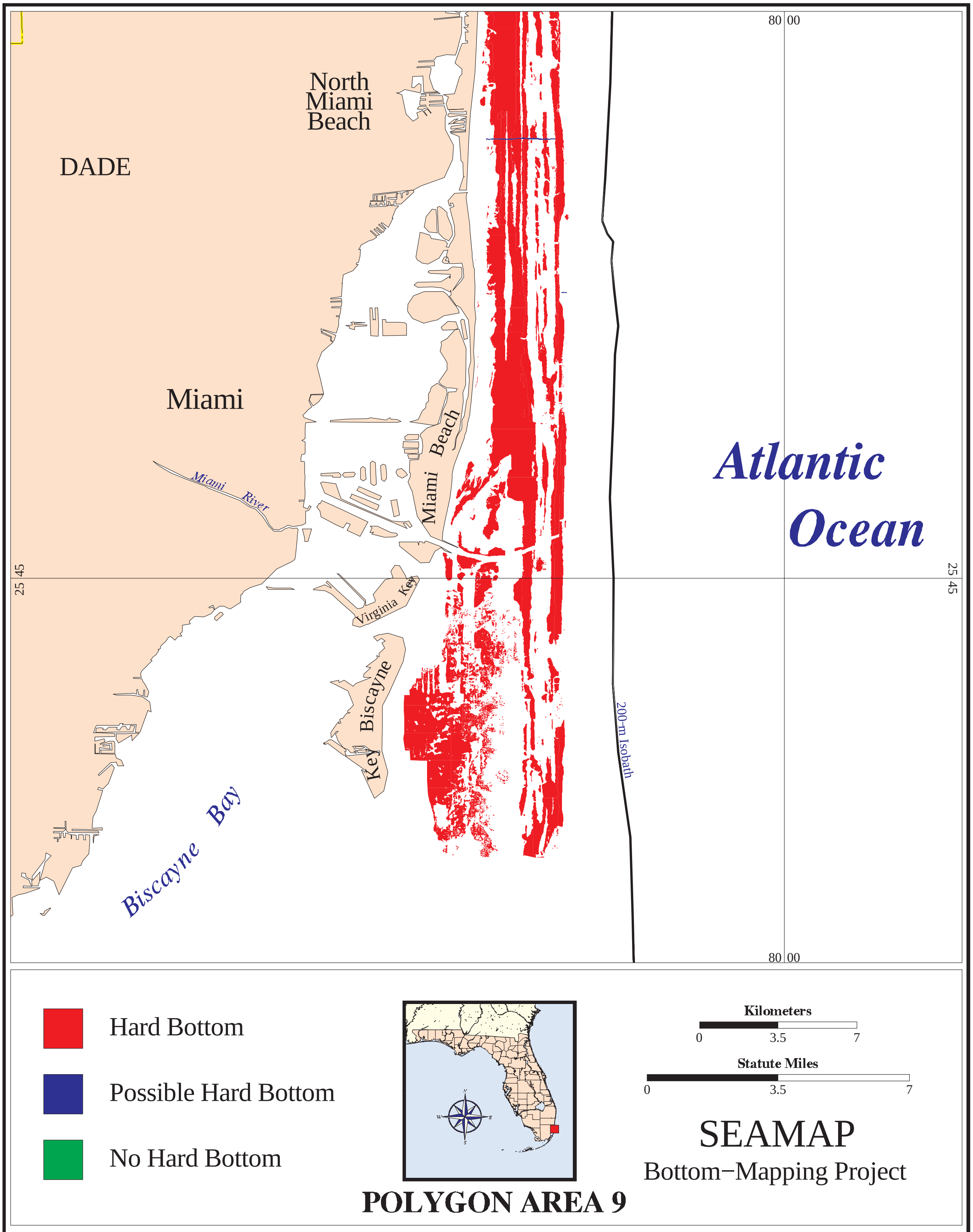


Figure 19 . Data from Coast of Florida Erosion & Storm Effects Study; Central Dade county.

determinations (HB, PH and HA), when compared with records showing no evidence of hard bottom, is found in the southern part of the area. The relative percentage of hard bottom-probable hard bottom decreases to the north and then apparently increases again in the northernmost 1/6 of the study area. An example of typical hard-bottom habitat off St. Lucie County in the southern part of the study area is shown in Figure 20. However, interpretation of hard-bottom locations based on our results for the entire database is problematic because much of the data from the northern and central parts of the survey area was obtained during fishery surveys in which investigators seek to avoid hard bottom, and hard bottom was targeted in six of the seven surveys conducted by HBOI that include data for the southern part of the region.

To examine the relative distribution of bottom types along the inner continental shelf, the percentages of the bottom types determined from examination of seismic data from the ICONS study (Database FT01; Meisburger and Duane, 1971; Meisburger and Field, 1975) were examined for each of the ICONS study areas (Table 8). The ICONS study examined nearshore bottom types along the entire area included in the Florida

Table 7. Latitudinal distribution of bottom types determined in the Florida database from all point and line-segment sources except artificial structures.

Latitude Range (Degrees and Minutes)	Records	HB+HA	PH	NH	%HB+PH
2656-2734	2,745	360	132	2,253	17.92
2734-2812	3,685	605	184	2,896	21.41
2812-2850	4,235	207	191	3,837	9.35
2850-2928	2,567	58	98	2,411	6.08
2928-3006	2,508	85	147	2,276	9.25
3006-3044	3,727	199	319	3,209	13.90
Totals/Average	19,467	1,514	1,071	16,882	17.19

segment of the bottom mapping study, with concentrated sampling in five areas, so the data obtained from that study may be a good indication of the true relative distribution of bottom types within the area studied. The data presented in Table 8 indicate that the area with the greatest percentage of hard bottom plus probable hard bottom nearshore is in the southern part of the Florida study area, and that the second highest percentage occurs in the extreme northern part of the area. The interpretation of the FT01 data is not affected by biases of targeting specific habitats for sampling and suggests that the
information in that data source indicates the true relative distribution of bottom types in the area that was sampled. These percentages are consistent with the relatively high percentages of hard-bottom-type determinations in the Florida database for the southern

Table 8. Nearshore distribution of bottom types determined in the Florida database by side-scan sonar.

Location	HB	PH	NH
Ft. Pierce	4.58	10.98	84.43
Vero Beach	1.17	1.17	97.66
Cape Canaveral	2.64	7.13	90.23
Cape Canaveral to St. Augustine	1.87	5.60	92.53
St. Augustine	2.13	8.01	89.86
St. Augustine to Jacksonville	1.01	7.86	91.13
Beverly Beach	0.19	7.09	92.72
Jacksonville	1.59	8.06	90.35
Jacksonville to Fernandina	0.51	3.29	96.20
Fernandina Beach	2.70	11.97	85.33

region and the moderately high percentages for the northernmost regions of the study area, determined from point and line data, and suggest that the database may indicate the true relative distribution of bottom types for the study area.

INFORMATION IN THE DATABASE ON IMPORTANT FLORIDA HABITATS

Records of the Coral *Oculina varicosa*. Formations composed of living colonies and dead skeletons of the scleractinian coral *Oculina varicosa* form an almost continuous band of reefs near the edge of the continental shelf (Figure 21). The habitat extends from the southern edge of the Florida study area to an unknown distance northward of Cape Canaveral (Avent et al., 1977; Reed, 1980, 1981, 1983, 1992). These reefs provide a very important habitat for hard-bottom fishes, and fishing is currently restricted in a large part of this area (see information presented above, database PAXX). Information on locations of this habitat is important in managing fisheries stocks as well as in protecting the habitat. All records in the database HB06 provide information on locations of the coral (39 records) and some *Oculina* locations are included in HB07 (16 records). In addition, information on localities of *O. varicosa* can be provided from numerous records in the database HB04. We can provide the information on most of these records, or the information can be requested from John R. Reed of HBOI. Many records associated with database HB05 indicate areas of very high relief (to about 30 m), and *Oculina* pinnacles may be found at some of these locations. Information on locations where *O. varicosa* was recorded can also be provided from FMRI data associated with the databases FL02, FL05, and FL06.

Indian River County Coquinoid-Rock/Sabellariid Reef. A nearshore band of hard bottom, up to about 1/2-mile wide and extending almost continuously along the

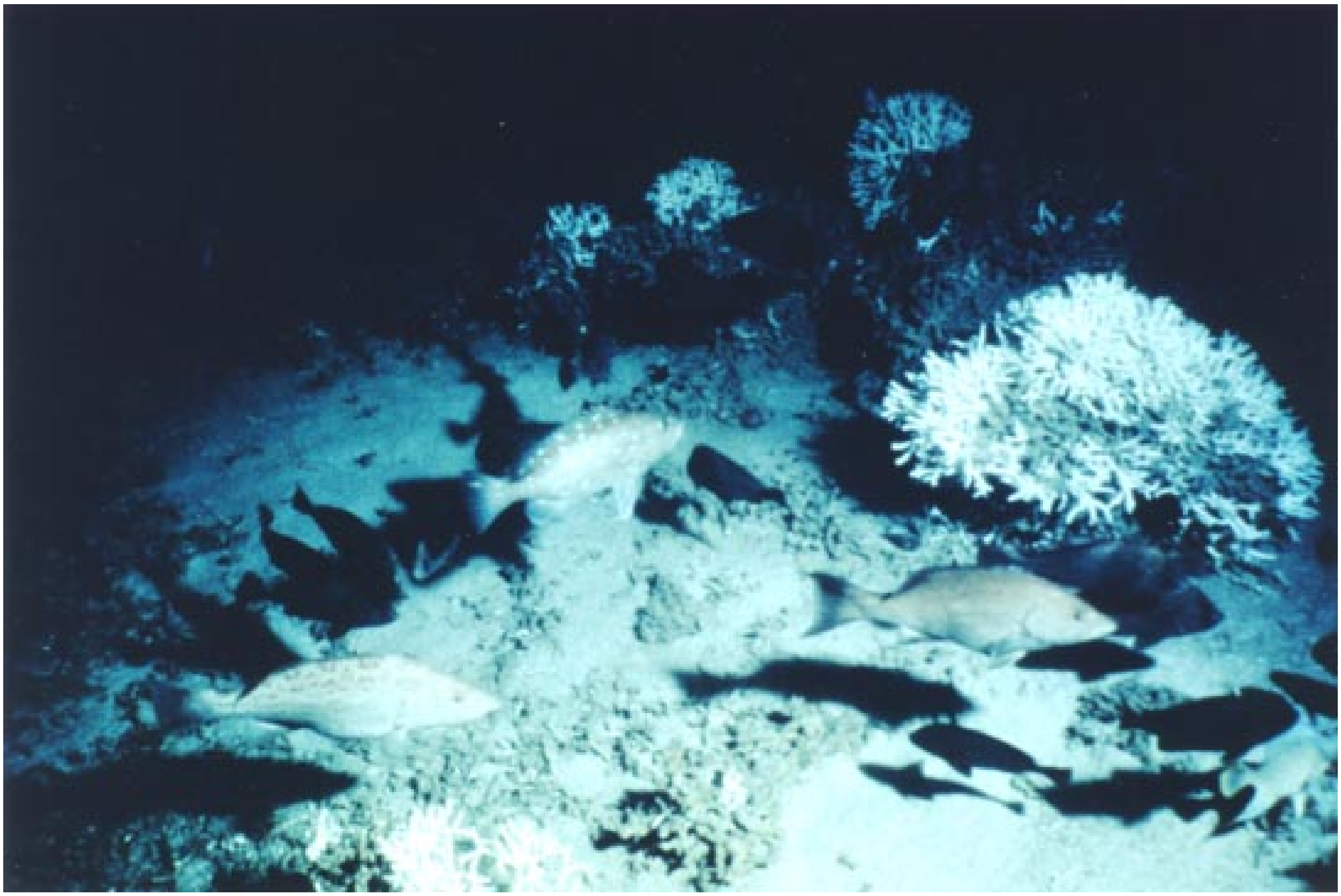
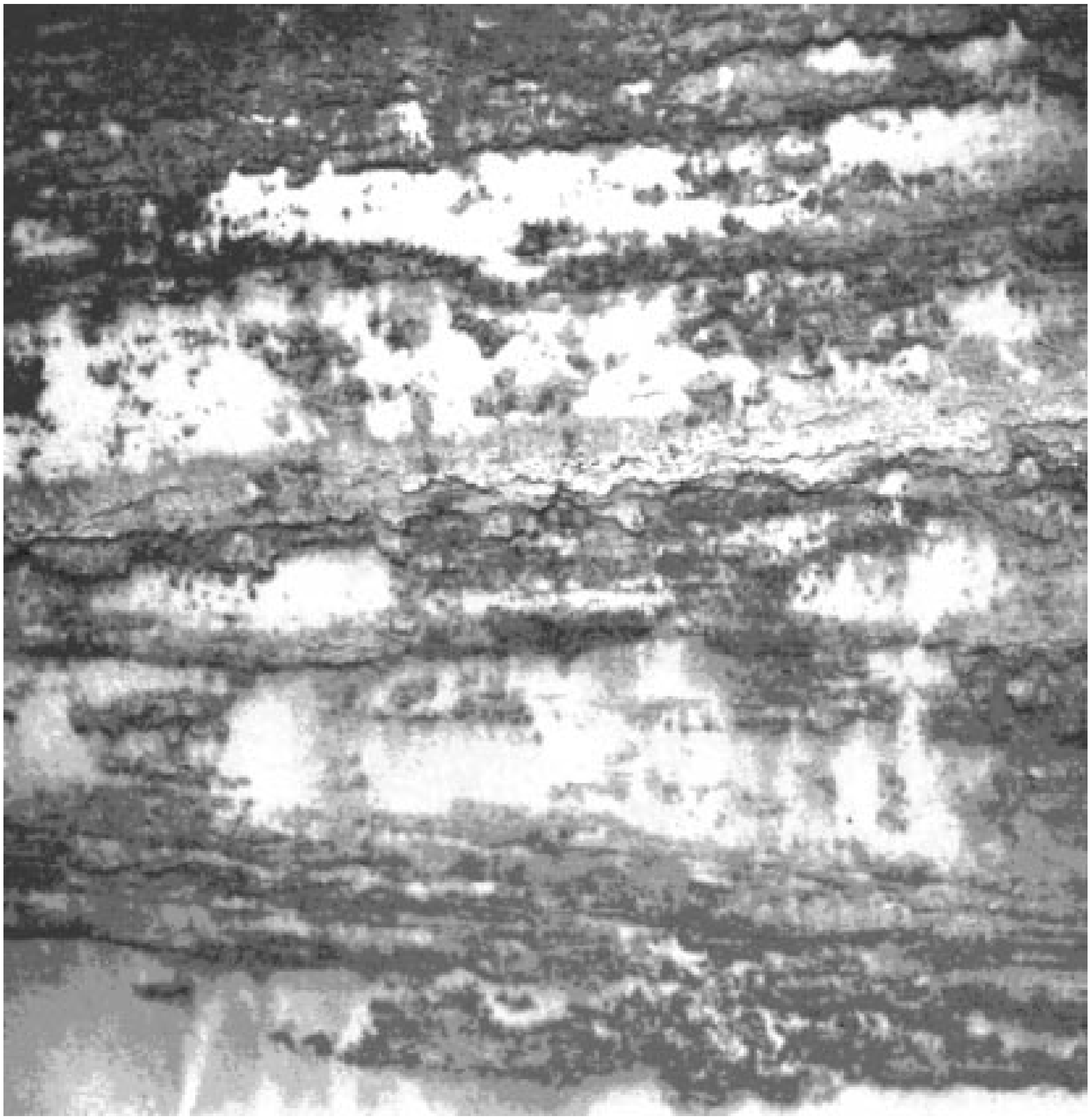


Figure 22. Intertidal sabellariid reef habitat, Brevard County.



coast of Indian River County and into Brevard County, was interpreted from aerial photography and is reported in database FL08 (Figure 14). This is almost certainly the habitat commonly identified as the Florida sabellariid reef. Sabellariidae are a family of polychaete worms that typically build tubes of sand cemented in a rigid matrix. The species that characterizes the Florida sabellariid reef, *Phragmatopoma caudata*, builds tubes in large, sub-cylindrical colonies of about 1-m diameter on hard substrate in high energy beach areas of southeastrn Florida, from the intertidal zone out to about 10-m depths (Figures 16, 17). The hard bottom on which the worms build their colonies is coquinoid rock. Most of the rock in the habitat is exposed or colonized by other biota. The Florida sabellariid reef community is essentially tropical. Colonies of the worm are known to occur from south of Key Biscayne north to near Cape Canaveral (Zale and Merrifield, 1989). They occur in the diminishing coral reef that extends from southern Dade County to northern Palm Beach County, but they are most significant as the principal component of the high-energy reef habitat that occurs off Martin, St. Lucie, and Indian River counties. There, the areal extent of the sabellariid reef habitat has not been previously reported, but our information indicates that it is enormous. The reef supports a diverse fauna of invertebrates and fishes, many of which are more or less restricted to the habitat. About 40 of the fishes are commercially or recreationally important (Gilmore et al., 1981; also see citations in Zale and Merrifield, 1989). A diverse flora of algae is also an important component of the habitat, and perhaps this is the part of the community that contributes most significantly to its value as an important habitat for immature stages of the threatened green sea turtle (Ehrhart, 1992).

DBASE AND ARCINFO DATABASE FILES

In addition to the dBase files assembled during the Florida segment of the SEAMAP bottom-mapping study (see Appendices 1-4), the following ArcInfo export files, sufficient to construct detailed maps showing geographic locations of bottom types determined for the Florida segment of the bottom-mapping study, have been provided to the SEAMAP data manager: 1) a file to construct the Florida coastline as shown in Figure 1, 2) a file for the Florida grid, 3) a file for the point data in the SEAMAP database for Florida, 4) a file for the line-segment data in the SEAMAP database for Florida, and 5) a file for each of the polygon databases assembled for the Florida segment of the SEAMAP bottom-mapping study. Electronic data for the Coast of Florida Erosion and Storm Effects Study (CEXX) will not be included.

All data files are available by request following review and approval. Submit written requests to: The SEAMAP Data Manager, National Marine Fisheries Service, Building 1103, Room 218, Stennis Space Center, Mississippi 39529-6000, Telephone No. (601) 688-3103.

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APPENDIX A. DATA DICTIONARIES AND EXAMPLES OF APPENDICES.

Data Dictionary and Example of Appendix 1: Primary database table containing locations of historical records that provide evidence of bottom type on the eastern continental shelf of Florida.

Database Codes:

BLOCK	=	Unique code for each 1-minute by 1-minute grid cell established for the survey area; code represents latitude and longitude of southeastern corner of grid cell (see Figure 1 in text).
DATE	=	Date (DDMMYY = day/month/year) of the collection or date of report publication if the collection date was unavailable.
AGENCY	=	Code for agency and project that provided data (see Appendix 2).
ORIGCOLL	=	Original collection number; typically the concatenation of identifying variables associated with the sampling event, e.g., cruise number, station number, vessel code.
START/LAT/LON	=	Data collection start coordinates in latitude and longitude, respectively. LORAN data were converted when necessary.
END/LAT/LON	=	Data collection end coordinates in latitude and longitude, respectively. LORAN data were converted when necessary.

POSMET = Code describing the positioning method used.

0 = Unknown
1 = LORAN-C
2 = LORAN-A
3 = GPS
4 = Range & Bearing
5 = Dead Reckoning
6 = Decca Hi-Fix System
7 = MiniRanger Positioning System (tm)
8 = Triangulation from Shore
9 = Stereoscopical Interpolation onto USGS Quads

CORFAC = Code describing any corrections made to position coordinates by the original researcher.

0 = Unknown
1 = None
2 = AFS
3 = Corrected to a benchmark or known landmark
4 = LORAN-C numbers converted by LORAT program
5 = Differentially corrected

GEAR = Code for gear and method used to collect data leading to determination of bottom type.

Aerial Photography (AF)
- AF01 = 1:7200 Registered Color Aerial Photography

Benthic Grab (BG)
- BG01 = Shipek Grab
- BG02 = Smith McIntyre Grab

Dredge (DR)
- DR01 = 8-ft by 3-ft Scallop Tumbler
- DR02 = 3-ft Box
- DR04 = 4-ft Nantucket Hydraulic Clam
- DR05 = Pipe
- DR06 = Scallop
- DR07 = Clam
- DR08 = Tumbler
- DR09 = Kirtley Dredge
- DR10 = Canvas Dredge

Trawl (BT, FT, ST and TT)
- BT05 = Blake; 5-ft
- FT01 = 3/4 scale Yankee Trawl,#36 body-L liner-A cod-E*
- FT03 = Semi-balloon 40/60 4-seam trawl*
- FT04 = Fish; Falcon (233 MRRI)
- FT06 = Fish; Standard Mongoose
- FT07 = Fish
- FT40 = Fish; 40-ft
- FT49 = Fish; 50-ft
- FT52 = # 36 or # 41 Yankee Trawl, w/disc sweeps
- FT56 = Fish; 55-ft Semi-balloon Otter
- ST05 = Shrimp; Otter, 5-ft Headrope
- ST09 = Shrimp
- ST10 = Shrimp; Otter, 10-ft Headrope
- ST12 = Shrimp; Otter, 12-ft Headrope
- ST16 = Shrimp; Otter, 16-ft Headrope
- ST20 = Shrimp; Otter, 20-ft Headrope
- ST21 = Shrimp; Otter, 21-ft Headrope, 1-in stretch mesh
- ST22 = Shrimp; Otter, 22-ft Headrope, 2-in stretch mesh

        TT10 = Try net; 10 ft
    Trap
        TR01 = Blackfish Trap, Baited*
        TR03 = Fine-Mesh Trap*
        TR05 = Chevron Trap
    Vibracore Sampler (VB)
        VB01 = 4-in inner diameter core sampler
        VB02 = 2-in inner diameter core sampler
        VB03 = 3.5-in inner diameter core sampler
    SCUBA (SD)
        SD01 = Dive from Vessel or Small Boat (Pop Dive)
    Submersible (SD, SL, Jn)
        SD02 = Johnson Sealink, Lockout Dive
        SL01 = Johnson Sealink, Undetermined
        J101 = Johnson Sealinh I, Photography
        J102 = Johnson Sealink I, Photography & Transcript
        J103 = Johnson Sealink I, Manipulator Arm
        J104 = Johnson Sealink I, Lockout Dive
        J201 = Johnson Sealink II, Photography
        J202 = Johnson Sealink II, Photography & Transcript
    Recording Fathometer (FA)
        FA01 = Raytheon DE Recording Fathometer or
            Hydroproducts Gifft Series 4000 Precision Depth
            Recorder
    Side-scan Sonar (SS)
        SS04 = Klein Series 595
        SS12 = EG & G model 259-3
    Subbottom Profiler (PR)
        PR01 = 3.5-kHz subbottom profiler:O.R.E.*
        PR03 = Sparker
    Closed Circuit TV (CC)
        CC01 = Black & White*
        CC02 = Color
Combination Gears
    Side-scan Sonar and Closed-circuit TV
        0151 = EG&G Model 259-3 and B&W TV*
    Side-scan Sonar and Subbottom Profiler
        0201 = EG&G Model 259-3 and Uniboom Subbottom
            Profiler:O.R.E*
        0205 = EG&G Model 259-3 and EDO 3.5 kHz Subbottom
            Profiler:EG&G Model 225*
    Side-scan Sonar, Close-circuit TV and Subbottom Profiler
        0401 = EG&G Model 259-3, B&W TV and 3.5 kHz Subbottom
            Profiler*

Subbottom Profiler and TV
0801 = 3.5-kHz Subbottom Profiler: O.R.E and B&W TV*
Closed-circuit TV and Recording Fathometer
1001 = Sled-mounted video camera and Raytheon DE-719
Closed-circuit on ROV and Recording Fathometer
1101 = Video camera mounted on HBOI CORD and Raytheon DE 121 or Hydroproducts Gifft Series 4000
Side-scan Sonar and Recording Fathometer
1201 = Klein Series 400 system and Raytheon DE 121 or Hydroproducts Gifft Series 4000
1202 = Klein Series 595 and Innerspace Model 400
1203 = Klein Model 590 Digtal Sonar System and Odum Echotrac DF 3200

DEPTH = Station depth, depth at start of towed gear, or depth range, in meters.

DEPTH_EN = Depth at end of towed gear in meters.

BTM_TYP = Code for bottom type as one of the following categories.
HB = hard bottom
PH = probable hard bottom
NH = no evidence of hard bottom
AR = artificial structure
HA = hard bottom and artificial structure

RELIEF = Maximum bottom relief in meters.
L = < 0.5
M = 0.5 - 2
H = > 2

STATE = State or states that assembled the data.
FL = Florida
SC = Georgia and South Carolina
NC = North Carolina

DATA_TYP = Code for the type of geographic coverage of the data.
P = point data
L = line-segment data
A = areal data

UNIQ_ID = Identification number unique to each record.

* For additional information, see Van Dolah et al. (1995).

Block	Date	Agency	Origcoll	Startlat	Startlon	Endlat	Endlon	Posmet	Corfac	Gear	Depth	Depth_en	Btm_typ	Relief	State	Data_typ	Uniq_id
28048032	4-Jun-75	CE03	10BRE	2804.09	8032.97			8	0	VB02	9		NH		FL	P	23961
27278016	5-Jun-79	CE03	10FTP	2727.01	8016.52			7	0	VB02	6		NH		FL	P	23962
28048032	5-Jun-75	CE03	11BRE	2804.41	8032.91			8	0	VB02	9		NH		FL	P	23963
27278016	11-Jun-79	CE03	11FTP	2727.05	8016.39			7	0	VB02	12		NH		FL	P	23964
28048033	5-Jun-75	CE03	12BRE	2804.74	8033.22			8	0	VB02	9		NH		FL	P	23965
28058033	9-Jun-75	CE03	13BRE	2805.08	8033.35			8	0	VB02	9		NH		FL	P	23966
28058032	16-Jun-75	CE03	13ESTB	2805.26	8032.41			8	0	VB02	16		NH		FL	P	23967
28058033	9-Jun-75	CE03	14BRE	2805.40	8033.47			8	0	VB02	8		NH		FL	P	23968
28058033	10-Jun-75	CE03	15BRE	2805.74	8033.59			8	0	VB02	9		NH		FL	P	23969
28038031	11-Jun-75	CE03	16BRE	2803.58	8031.60			8	0	VB02	15		NH		FL	P	23970
28038031	11-Jun-75	CE03	19BRE	2803.67	8031.52			8	0	VB02	16		NH		FL	P	23971
28038032	3-Jun-75	CE03	1BRE	2803.58	8032.91			8	0	VB02	7		NH		FL	P	23972
27268016	1-Jun-73	CE03	1FTP	2726.97	8016.43			8	0	VB03	5		NH		FL	P	23973
28048031	17-Jun-75	CE03	24BRE	2804.08	8031.35			8	0	VB02	17		NH		FL	P	23974
28048029	17-Jun-75	CE03	27BRE	2804.23	8029.95			8	0	VB02	18		NH		FL	P	23975
28038033	4-Jun-75	CE03	2BRE	2803.92	8033.00			8	0	VB02	7		NH		FL	P	23976
27278016	1-Jun-73	CE03	2FTP	2727.45	8016.61			8	0	VB03	6		NH		FL	P	23977
28048031	17-Jun-75	CE03	33BRE	2804.74	8031.25			8	0	VB02	17		NH		FL	P	23978
28048033	4-Jun-75	CE03	3BRE	2804.25	8033.12			8	0	VB02	7		NH		FL	P	23979
27278016	1-Jun-73	CE03	3FTP	2727.87	8016.82			8	0	VB03	6		NH		FL	P	23980
27288016	4-Jun-79	CE03	4AFTP	2728.13	8016.93			7	0	VB02	6		NH		FL	P	23981
28048033	5-Jun-75	CE03	4BRE	2804.58	8033.25			8	0	VB02	8		NH		FL	P	23982
27288016	4-Jun-79	CE03	5AFTP	2728.15	8016.80			7	0	VB02	7		NH		FL	P	23983
28048033	5-Jun-75	CE03	5BRE	2804.91	8033.38			8	0	VB02	7		NH		FL	P	23984
27278016	8-Jun-79	CE03	5FTP	2727.67	8016.66			7	0	VB02	7		NH		FL	P	23985
28058033	10-Jun-75	CE03	6BRE	2805.24	8033.50			8	0	VB02	8		NH		FL	P	23986
27278016	4-Jun-79	CE03	6FTP	2727.47	8016.72			7	0	VB02	5		NH		FL	P	23987
28058032	22-Jun-76	CE03	7610BR	2805.04	8032.76			7	0	VB02	13		NH		FL	P	23988
28058032	22-Jun-76	CE03	7611BR	2805.09	8032.58			7	0	VB02	14		NH		FL	P	23989
28048032	25-Jun-76	CE03	7613AB	2804.67	8032.64			7	0	VB02	13		NH		FL	P	23990
28048032	23-Jun-76	CE03	7613BR	2804.88	8032.71			7	0	VB02	13		NH		FL	P	23991
28048032	24-Jun-76	CE03	7614AB	2804.78	8032.44			7	0	VB02	14		NH		FL	P	23992
28048032	23-Jun-76	CE03	7614BR	2804.92	8032.53			7	0	VB02	14		NH		FL	P	23993
28058033	22-Jun-76	CE03	761BRE	2805.31	8033.05			7	0	VB02	12		NH		FL	P	23994
28058033	24-Jun-76	CE03	7620BR	2805.64	8033.19			7	0	VB03	12		NH		FL	P	23995
28058032	18-Jun-76	CE03	762BRE	2805.35	8032.87			7	0	VB02	13		NH		FL	P	23996
28058032	17-Jun-76	CE03	763BRE	2805.39	8032.69			7	0	VB02	14		NH		FL	P	23997
28058033	10-Jun-75	CE03	7BRE	2805.57	8033.62			8	0	VB02	8		NH		FL	P	23998
28058033	12-Jun-75	CE03	7EST2B	2805.65	8033.34			8	0	VB02	11		NH		FL	P	23999
28058032	16-Jun-75	CE03	7EST3B	2805.79	8032.61			8	0	VB02	15		NH		FL	P	24000
28058033	12-Jun-75	CE03	7ESTBR	2805.60	8033.50			8	0	VB02	9		NH		FL	P	24001
27278016	5-Jun-79	CE03	7FTP	2727.51	8016.59			7	0	VB02	6		NH		FL	P	24002
28058033	10-Jun-75	CE03	8BRE	2805.91	8033.74			8	0	VB02	6		NH		FL	P	24003
27278016	5-Jun-79	CE03	8FTP	2727.16	8016.59			7	0	VB02	7		NH		FL	P	24004
28038032	4-Jun-75	CE03	9BRE	2803.75	8032.85			8	0	VB02	9		NH		FL	P	24005
27278016	11-Jun-79	CE03	9FTP	2727.21	8016.46			7	0	VB02	5		NH		FL	P	24006

Data Dictionary and Example of Appendix 2: Secondary database table containing information on the source of each record in the primary database table.

Database Codes

AGENCY = Agency project code for relation to primary database.

- CA02 = Continental Shelf Associates, Inc. Canaveral Harbor dredge candidate disposal site, 1987.
- CA03 = Continental Shelf Associates, Inc. Fernandina Harbor dredge candidate disposal site, 1986.
- CA04 = Continental Shelf Associates, Inc. Side-scan sonar and hydrographic survey of nearshore Brevard County.
- CE03 = U.S. Army Corps of Engineers vibracore data for study region.
- CEXX = U.S. Army Corps of Engineers, Jacksonville District, Coast of Florida Erosion and Storm Effects Study.
- EP03 = US Environmental Protection Agency, Region 4. Survey of Jacksonville Harbor Ocean Dredged Material Disposal Site.
- EP04 = US Environmental Protection Agency, Region 4. Survey of Fort Pierce Harbor Ocean Dredged Material Disposal Site.
- FL01 = Florida Marine Research Institute, Federal Clam Project.
- FL02 = Florida Marine Research Institute, Rock Shrimp Project.
- FL03 = Florida Marine Research Institute, Hutchinson Island Nuclear Power Plant Envirommental Study.
- FL04 = Florida Marine Research Institute, St. Lucie Power Plant 316a Study.
- FL05 = Florida Marine Research Institute, SEAMAP East Coast Benthic Faunal Mapping Study.
- FL06 = Florida Marine Research Institute, miscellaneous records in the Specimen Collection Database.
- FL07 = Florida Department of Environmental Protection, Office of Fisheries Management and Assistance

Services records of artificial reef locations, 1985-1995.

FL08 = Indian River Co. - Sebastian Inlet Taxing Dist. Aerial photographic survey of nearshore waters of Indian River County, 1994.

FL09 = Artificial reef data from "Atlas of Artificial Reefs in Florida - Fourth Edition" (Pybas, 1991).

FL10 = Artificial reefs and structures. Data provided by county governments, port authorities, & other county groups, Florida Oceanographic Society, Inc., Loran TDs.

FL11 = Artificial reefs and structures. Data provided by county governments, port authorities, & other county groups, Florida Oceanographic Society, Inc., GPS coordinates.

FT01 = U.S. Army Corps of Engineers studies of geomorphology and sediments of the inner continental shelf, Palm Beach, Florida, to Georgia, side-scan sonar data, 1965-1966 (Meisburger & Duane, 1971; Meisburger & Field, 1975).

FT02 = U.S. Army Corps of Engineers studies of geomorphology and sediments of the inner continental shelf, Palm Beach, Florida, to Georgia, vibracore sample data, 1965-1966 (Meisburger & Duane, 1971; Meisburger & Field, 1975).

GO01 = *General Oceanographics, Inc., Geologic Drilling Hazzard Survey, Federal OCS Lease Block 471 (G-3698).

GO02 = *General Oceanographics, Inc., Geologic Drilling Hazzard Survey, Federal OCS Lease Block 252 (G-3689).

GO03 = *General Oceanographics, Inc., Geologic Drilling Hazzard Survey, Federal OCS Lease Block 427 (G-3695).

GO04 = *General Oceanographics, Inc., Geologic Drilling Hazzard Survey, Federal OCS Lease Block 472 (G-3699).

GO05 = *General Oceanographics, Inc., Geologic Drilling Hazzard Survey, Federal OCS Lease Block 383 (G-3692).

GO06 = *General Oceanographics, Inc., Geologic Drilling Hazzard Survey, Federal OCS Lease Block 384 (G-

3684).

GO08 = General Oceanographics, Inc. (1978). Side-scan sonar data from Geologic Drilling Hazzard Survey, Federal OCS Lease Block 564.

GR01 = *Georgia Department of Natural Resources Offshore Fishing Guide, 1991.

HB01 = Harbor Branch Oceanographic Institution, Inc., East Florida Shelf Trawl and Dredge Survey, 1973-1978.

HB02 = Harbor Branch Oceanographic Institution, Inc., East Florida Shelf Submersible Reconnaissance Program, photographic transects.

HB03 = Harbor Branch Oceanographic Institution, Inc., East Florida Shelf Submersible Reconnaissance Program, written description of transects.

HB04 = Harbor Branch Oceanographic Institution, Inc., East Florida Shelf SCUBA Reef Survey, 1974-1982.

HB05 = Harbor Branch Oceanographic Institution, Inc., Side-scan Sonar Survey, 1977-1978.

HB06 = Harbor Branch Oceanographic Institution, Inc., Fathometer Survey, 1981.

HB07 = Harbor Branch Oceanographic Institution, Inc., CORD Remotely Operated Vehicle Survey, 1982.

MR08 = *MARMAP Program Data. Years 1973-1995 (SCWMRD).

MR09 = MARMAP Program Data. Years 1993-1995 (SCWMRD).

MR11 = SEAMAP Program Data. Years 1992-1994 (SCWMRD).

MR12 = *SEAMAP Program Data. Years 1986-1993 (SCWMRD).

NT01 = Red Snapper Sink, NOAA NOS Chart 11480, Charleston Light to Cape Canaveral.

PA02 = NOAA-NMFS Southeast Fisheries Science Center, bottom trawl and dredge data, 1956-1988.

PA03 = NOAA-NMFS Southeast Fisheries Science Center, bottom trawl data, 1989-1994.

SC01 = Sea Systems Corporation. Side-scan sonar and hydrographic survey, Martin County Shore Protection Project, 1963.

SC02 = Sea Systems Corporation. Side-scan sonar and hydrographic survey, St. Johns County Beach Erosion Control Project, 1994.

SP05 = Data from "Hot Spots - Northeast Florida Loran Guide" (The Jacksonville Scubanauts & The Jacksonville Offshore Sport Fishing Club, 1991).

UG01 = *Ocean Bottom Survey of U.S. South Atlantic OCS Region, Final Report to BLM.

UG02 =		*Side-scan sonar survey of the inner continental shelf of Georgia.
WH01 =		NOAA-NMFS, Northeast Fisheries Science Center, Woods Hole Facility, groundfish bottom trawl data, 1972 & 1974.

POS_PREC = Position precision (original units in which position was reported).

1	=	Precision unknown
2	=	Nearest minute of latitude and longitude.
3	=	Nearest tenth of a minute of latitude and longitude.
4	=	Nearest hundredth of a minute of latitude and longitude.
5	=	Loran TD units only.
6	=	Interpolated from map to nearest tenth of a minute of latitude and longitude.
7	=	Interpolated from map to nearest hundredth of minute of latitude and longitude.
8	=	Start position reported to nearest minute of latitude and longitude, end position reported in Loran TD units.
9	=	Reported in state planar coordinates (NAD 27).
A	=	Reported in Loran TD units or to the nearest tenth of a minute of latitude and longitude.
B	=	Reported in Loran TD units, or to the nearest minute, tenth of minute or hundredth of minute of latitude and longitude.
C	=	Interpolated from aerial photographs onto USGS Quads.

SOURC_CO = State from which data was obtained.

FL	=	Florida
GA	=	Georgia
SC	=	South Carolina

PROJ_TIT	=	Project title
FUND_AGE	=	Source of original funding
GRANT_NU	=	Original grant number
PRIN_INV	=	Principal investigator
COMPANY	=	Company information
STREET	=	Street address
CITY	=	City

STATE	=	State
ZIP	=	Zip code
FAX	=	FAX number
PHONE	=	Phone number

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* For additional information, see the report for the South Carolina-Georgia segment of the bottom-mapping study (Van Dolah et al., 1994).

AGENCY_P: CA02
POS_PREC: 4
SOURC_CO: FL
PROJ_TIT: Field Survey of the Fernandina Harbor Candidate Ocean Dredge Material Disposal Site
FUND_AGE: USACOE
GRANT_NU:
PRIN_INV: Keith D. Spring
COMPANY: Continental Shelf Assoc., Inc.
STREET: 759 Parkway Street
CITY: Jupiter
STATE: FL
ZIP: 33477
FAX: 561-747-2954
PHONE: 305-746-7946

AGENCY_P: CA03
POS_PREC: 4
SOURC_CO: FL
PROJ_TIT: Field Survey of the Canaveral Harbor Candidate Ocean Dredge Material Disposal Site
FUND_AGE: USACOE
GRANT_NU:
PRIN_INV: Cont. Shelf Assoc.
COMPANY: Continental Shelf Assoc., Inc.
STREET: 759 Parkway Street
CITY: Jupiter
STATE: FL
ZIP: 33477
FAX: 561-747-2954
PHONE: 561-746-7946

AGENCY_P: CA04
POS_PREC: 9
SOURC_CO: FL
PROJ_TIT: Side-scan Sonar & Hard Bottom Mapping Brevard Co. Shore Prot. Study, Surv. No. 94-249
FUND_AGE: USACOE-EMC
GRANT_NU:
PRIN_INV: Cont. Shelf Assoc.
COMPANY: Continental Shelf Assoc., Inc.
STREET: 759 Parkway Street
CITY: Jupiter
STATE: FL
ZIP: 33477
FAX: 561-747-2954
PHONE: 561-746-7946

AGENCY_P: CE03
POS_PREC: 9
SOURC_CO: FL
PROJ_TIT: U.S. Army Corps of Engineers, Jacksonville District, Vibracore database
FUND_AGE: USACOE, Jacksonville
GRANT_NU:
PRIN_INV: Doug Rosen
COMPANY: USACE, Jacksonville District
STREET: P.O. Box 4970
CITY: Jacksonville
STATE: FL
ZIP: 32232
FAX: 904-232-3665
PHONE: 904-232-1617

AGENCY_P: CEXX
POS_PREC: 9
SOURC_CO: FL
PROJ_TIT: U.S. Army Corps of Engineers, Coast of Florida Erosion and Storm Effects Study
FUND_AGE: USACOE, Jacksonville
GRANT_NU:
PRIN_INV: Mitch Granite
COMPANY: USACE, Jacksonville District
STREET: P.O. Box 4970
CITY: Jacksonville
STATE: FL
ZIP: 32232
FAX: 904-232-1839
PHONE: 904-232-3442

AGENCY_P: EP03
POS_PREC: 4
SOURC_CO: FL
PROJ_TIT: U.S. Environ. Protection Agency Surv. of Jacksonville Harbor Ocean Dredg. Mat. Disposal Site
FUND_AGE: USEPA, Region 4
GRANT_NU:
PRIN_INV: C. J. McArthur
COMPANY: USEPA Region 4
STREET: 100 Alabama St., SW
CITY: Atlanta
STATE: GA
ZIP: 30303
FAX: 404-562-9343
PHONE: 404-562-9391

AGENCY_P: EP04
POS_PREC: 4
SOURC_CO: FL
PROJ_TIT: U.S. Environ. Protection Agency Surv. of Fort Pierce Harbor Ocean Dredged Material Disposal Site
FUND_AGE: USEPA, Region 4
GRANT_NU:
PRIN_INV: C. J. McArthur
COMPANY: USEPA Region 4
STREET: 100 Alabama St., SW
CITY: Atlanta
STATE: GA
ZIP: 30303
FAX: 404-562-9343
PHONE: 404-562-9391

AGENCY_P: FL01
POS_PREC: 5
SOURC_CO: FL
PROJ_TIT: Florjda Department of Natural Resources Federal Clam Project
FUND_AGE: NOAA/NMFS
GRANT_NU: PL 88-309, No. 2-134-R
PRIN_INV: M. F. Godcharles
COMPANY: Florida Marine Research Inst.
STREET: 100 Eighth Avenue, S.E.
CITY: St. Petersburg
STATE: FL
ZIP: 33701
FAX: 813-823-0166
PHONE: 813-896-8626

Data Dictionary and Example of Appendix 3: Secondary database table that summarizes the number of data records and occurrence of bottom type in each 1-minute x 1-minute grid cell of the area surveyed.

Database Codes

Block	=	Block number
N_Obs	=	Total number of observations within block.
HB	=	Number of records with evidence of hard bottom within block, point and line-segment data.
PH	=	Number of records with probable hard bottom within block, point and line-segment data.
NH	=	Number of records with no evidence of hard bottom within block, point and line-segment data.
AR	=	Number of records with evidence of artificial reef structure.
HA	=	Number of records with combined hard bottom and artificial reef.

BLOCK	N_OBS	HB	PH	NH	AR	HA
26547959	1	1				
26548000	5	5				
26548001	10	9	1			
26548002	1	1				
26548003	3	2	1			
26557959	6	6				
26558000	5	5				
26558001	16	16				
26558002	2			2		
26558003	9	3	3	3		
26558004	18	13	5			
26567954	1			1		
26567955	3			3		
26567956	10			10		
26567957	1			1		
26567958	2	1		1		
26567959	35	24		11		
26568000	9	6		3		
26568001	20	20				
26568002	3	2		1		
26568003	7	1		6		
26568004	18	10	8			
26577953	2			2		
26577954	3			3		
26577957	7			7		
26577958	14	4		10		
26577959	15	7		8		
26578000	24	21		2	1	
26578001	5	5				
26578002	1			1		
26578003	2			2		
26578004	210	129	81			
26587954	3			3		
26587958	2			2		
26587959	5	3		2		
26588000	9	7		2		
26588001	3	1		2		
26588002	1			1		
26588004	41	21	19	1		
26597954	3			3		
26597955	2			2		
26597958	2			2		
26598000	2			2		
26598001	2			2		
26598002	2			2		
26598003	3	1		2		
26598004	2			2		
27007953	1			1		
27007954	1			1		
27007955	2			2		
27008000	2			2		
27008001	2			2		
27008003	1			1		
27008004	5			5		
27017955	3			3		
27017958	2			2		
27017959	3			3		
27018001	1			1		
27018002	1			1		
27018004	3			3		
27018005	1			1		
27027956	2			2		
27027958	1			1		
27028003	1			1		
27028004	2			2		
27028005	1			1		
27037954	1			1		
27037958	1			1		
27037959	3			3		
27038003	2	1	1			

BLOCK	N_OBS	HB	PH	NH	AR	HA
27038004	1			1		
27038005	2			2		
27047954	2			2		
27048000	1			1		
27048003	1		1			
27048004	4		2	2		
27048005	4			4		
27048006	3			3		
27057954	1			1		
27057956	1			1		
27058004	2			2		
27058005	1			1		
27058006	3			3		
27067954	1			1		
27067959	2	1		1		
27068000	1			1		
27068001	1			1		
27068002	1			1		
27068005	2			2		
27077959	2			2		
27078000	1			1		
27078002	1			1		
27078005	2			2		
27087954	1			1		
27088001	5	2		3		
27088003	1				1	
27088005	2			2		
27088006	3			3		
27088007	3			3		
27088008	2	1		1		
27097955	1			1		
27097957	1			1		
27097959	1			1		
27098001	1			1		
27098002	1			1		
27098003	5			1	4	
27098007	3			3		
27098008	2	1		1		
27107953	1			1		
27107955	1	1				
27107956	1	1				
27108000	12	11	1			
27108001	15	12		3		
27108002	8	7		1		
27108004	2	1		1		
27108007	3			3		
27108008	12	11	1			
27108009	38	30		8		
27117952	1			1		
27117955	1	1				
27117956	6	6				
27117957	17	16		1		
27117958	14	6		8		
27117959	3			3		
27118000	38	32		6		
27118001	31	22		8	1	
27118002	5			4	1	
27118005	1			1		
27118007	2			2		
27118008	4			4		
27118009	24	19		5		
27127954	2			2		
27127955	4	1		3		
27127956	16	11		5		
27127957	3	3				
27127958	5	4		1		
27127959	5	2	1	2		
27128000	12	8	1	3		
27128001	54	29		25		
27128002	10	3		2	5	

Data Dictionary and Example of Appendix 4: Secondary database table that summarizes information derived from polygon data on number of observations and areal percentages in grid cells of hard bottom, probable hard bottom, and no evidence of hard bottom. Percentages of area within grid cells not surveyed, surveyed but not reported, or outside the study area (e.g., on land) are not reported. Percentages of area reported in the data table as 0.00% represent less than 0.005% of the grid cell.

Database codes:

Block	=	Unique code for each 1-minute by 1-minute grid cell established for the survey area that contains information on bottom type, as derived from polygon data; code represents latitude and longitude of southeastern corner of grid cell (see Figure 1 in text).
N_OBS	=	Total number of observations of polygons within grid cell.
HB_PCT	=	Percentage of area within grid cell that shows evidence, as derived from polygon data, of hard bottom.
PH_PCT	=	Percentage of area within grid cell that shows evidence, as derived from polygon data, of probable hard bottom.
NH_PCT	=	Percentage of area within grid cell, as derived from polygon data, that shows no evidence of hard bottom.

BLOCK	N_OBS	HB_PCT	PH_PCT	NH_PCT
26547959	1	1.12		
26548000	5	2.60		
26548001	8	72.91		
26548002	1	1.19		
26548003	3	0.06	0.02	
26557959	3	29.34		
26558000	3	7.23		
26558001	14	36.29		
26558003	6	0.54	*	
26558004	18	0.43	0.53	
26567959	3	33.13		
26568000	4	37.72		
26568001	20	26.88		
26568002	2	1.27		
26568004	18	0.24	0.63	
26577959	2	18.08		
26578000	16	30.76		
26578001	5	14.83		
26578004	210	3.80	2.66	
26587959	2	0.66		
26588000	7	4.42		
26588001	1	2.10		
26588004	40	0.47	0.32	
27108008	12	0.98	0.08	
27108009	38	8.27		0.88
27118008	1			5.42
27118009	22	1.84		10.23
27128008	1			26.29
27128009	1			56.09
27128010	6	0.02	*	
27138008	1			7.38
27138009	1			18.25
27138010	31	0.81		
27148010	11	3.29		0.02
27148011	86	1.56		0.01
27158011	41	0.53		
27168011	1	0.05		
27278011	1			55.00
27278012	1			55.00
27338018	5	15.65		
27338019	3	18.16		
27348018	1	0.91		
27348019	1	39.34		
27358019	8	47.45		
27368019	1	44.59		
27368020	1	10.55		
27378019	1	0.19		
27378020	3	0.83		
27388020	6	13.85		
27388021	1	7.08		
27398020	3	0.43		
27398021	4	28.71		
27408021	6	33.82		
27418021	6	28.48		
27418022	1	3.54		
27428021	2	2.59		
27428022	1	27.58		
27438022	1	33.77		
27448022	2	31.51		
27448023	1	7.64		

BLOCK	N_OBS	HB_PCT	PH_PCT	NH_PCT
27458022	1	3.18		
27458023	6	35.97		
27468023	8	10.73		
27468024	6	8.10		
27478024	12	13.72		
27488024	12	3.38		
27488025	8	7.24		
27498025	10	13.77		
27508025	3	5.61		
27508026	3	15.37		
27518026	10	5.60		
27528026	7	0.29		
27528027	5	0.90		
28018032	1			3.26
28028032	1			40.67
28038032	1			26.20
28038033	1			13.64
28048032	1			0.44
28048033	1			39.09
28058033	1			37.92
28058034	1			1.23
28068033	1			14.12
28068034	1			24.62
28078034	1			38.44
28088034	1			38.50
28098034	1			28.52
28098035	1			9.96
28108034	1			4.43
28108035	1			33.89
28118035	1			37.96
28128035	1			37.66
28138035	1			37.74
28148035	1			28.02
28148036	1			9.80
28158035	1			10.98
28158036	1			26.70
28168029	1			0.31
28168030	1			0.43
28168035	1			0.86
28168036	1			36.64
28178028	1			0.05
28178029	1			55.29
28178030	1			70.50
28178031	1			7.73
28178036	1			37.43
28188028	1			18.72
28188029	1			96.81
28188030	1			100.00
28188031	1			89.26
28188032	1			9.59
28188036	1			37.49
28198029	1			18.01
28198030	1			61.69
28198031	1			47.99
28198036	2			37.27
28208035	1			0.83
28208036	2			36.44
28218035	1			12.64
28218036	1			25.19
28228035	1			33.10